ORDER

6530.11A

FA-10121 VHF/DF INSTALLATION STANDARDS HANDBOOK

2/4/94

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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RECORD OF CHANGES

DIRECTIVE NO. 6530.11A

CHANGE TO BASIC	SUPPLEMENT			OPTIONAL	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL

FAA Form 1320-5 (6-80) USE PREVIOUS EDITION

FOREWORD

This order sets forth in one document the technical guidance for installing the FA-10121 very high frequency direction finder (VDF) equipment at air navigation facilities. It provides the drawings for locating the DF equipment and its antenna masts at the facilities, a step-by-step procedure for installing the equipment and applicable interface and interconnection wiring diagrams.

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and Landing

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CHAPTER 1. GENERAL

1. PURPOSE. This order provides direction for installing the FA-10121 Very High Frequency Direction Finder (VDF), its antenna, and ancillary equipment at existing air navigation facilities and new sites. The text provides a brief description of the equipment's functional and physical characteristics, defines a step-by-step procedure for installing the equipment, and presents interface and interconnection wiring diagrams.

2. DISTRIBUTION. This order is distributed to the branch level in the office of the Program Director for Navigation and Landing; NAS System Engineering, Systems Maintenance, and Operational Support; division level in the Flight Standards, and Air Traffic Plans and Requirements Services; to branch level in the regional Airway Facilities, Air Traffic, Airports, and Flight Standards divisions; to director level at the FAA Technical Center; and to branch level at the Mike Monroney Aeronautical Center; and limited distribution to Airway Facilities General NAS Sectors and sector field offices, sector field units and sector field office units.

3. CANCELLATION. Order 6530.11, FA-10121 VHF/DF Installation Standards Handbook, dated 17 October 1990, is hereby canceled.

4. BACKGROUND. In the FAA efforts to upgrade and automate the National Airspace System (NAS), the FAA is procuring FA-10121 VDF equipment. The new equipment is solid state and designed to provide greater reliability in the field. This equipment will replace the FA-5530 VDF and also will be installed at additional sites providing a greater coverage area for direction-finding equipment.

5. SCOPE.

a. This order provides direction for installing the FA-10121 VDF, its antenna, and ancillary items at air navigation facilities. The text provides a brief description of the equipment's operational, functional, and physical characteristics, defines a step-by-step procedure for installing the equipment, and presents applicable interface and interconnection wiring diagrams.

b. The information presented provides only FA-10121 VDF and associated equipment guidance and direction. Once the FA-10121 equipment is installed, the applicable manufacturer furnished instruction books, or appropriate references, shall be referred to for equipment operating and checkout procedures.

6. SAFETY. Personnel shall exercise care at all times while working on equipment where dangerously high voltages are employed. This is especially true when plates and dust covers are removed or access doors are opened, exposing internal wiring. Contact with alternating current (ac), direct current (dc) or radio frequency (RF) potentials can result in severe shock, burns, or loss of life. Maintenance personnel should familiarize themselves with the technique for resuscitation found in the manual of first aid instructions. All individuals should be thoroughly familiar with general safety practices prior to working on equipment so as not to endanger

themselves or others. Operating and maintenance personnel should refer to Orders 6000.15A, General Maintenance Handbook for Airway Facilities, and 3900.6A, Occupational Safety Program for Airway Facilities Personnel. Ignorance and carelessness are predominate factors in most accidents. Particular attention shall be given to the proper use of the grounding rods prior to working on high voltage circuits. Under certain conditions, dangerous potentials may exist in circuits with power controls in the "OFF" position due to charges retained in capacitors. To avoid injuries, always remove power then discharge and ground by use of a grounding rod prior to touching any parts.

7. DIRECTIVE VERBS. This order contains policy statements and/or other guidance material wherein directive verbs such as SHALL, SHOULD, WILL, and MAY are used. The following rules of usage apply:

a. Shall is used to denote compulsory or mandatory action which the person directed is obliged to take. Example: The equipment SHALL be adjusted to operate in accordance with handbook tolerances.

b. Should is used to denote an action which is strongly recommended, but left to the discretion of the person being directed. Example: The equipment SHOULD be shutdown if, in the opinion of the technician, catastrophic failure is imminent.

c. Will is used to denote action in the future tense. Example: Obsolete equipment WILL be replaced as soon as funds can be made available.

d. May is used to denote permission. Example: At navigation air facilities, certain maintenance activities MAY be performed without recourse to flight inspection.

8. FAA DRAWINGS. The drawings included in this order as standards references are listed in table 1-1.

TABLE 1-1. FAA INSTALLATION DRAWINGS

DRAWING	TITLE
2001102	Remote Site Installation Interconnection Diagram
2005101	Local Site Installation Interconnection Diagram
2002011	Information Display and Control Unit (IDCU) Console Outline and Mounting Detail
2005012	DF Antenna Installation Drawing
2005205	Battery Simulator

TABLE 1-1. (cont.)

2001204	Remote Maintenance Monitoring and Control (RMMC)/IDCU Ethernet Interface
2005011	Target Antenna Installation

9. COMMISSIONING DATA. Prior to the commissioning of the DF equipment, a Joint Acceptance Inspection (JAI) shall be completed. Information on the JAI and each organizations responsibilities can be found in Order 6030.45A, Facility Reference Data File.

10. WAIVERS. Facility configuration must be standardized to allow for future standard enhancements to the facility. The instructions, standards, drawings, and procedures contained in this order represent FAA's baseline and standard criteria concerning VDF equipment. Some facilities under the purview of this order have been commissioned prior to the effective date of this order using equipment which has been procured without the benefit of FAA-approved specifications. Existing facilities on the effective date of this order which are not in compliance with this order shall be considered nonstandard facilities.

a. Regional procurement of equipment and devices which are to be used for air traffic control of navigation for which specifications have not been received prior to FAA approval is prohibited by Order 1100.5C, FAA Organization-Field, subparagraph 222j(2). The inclusion of such nonstandard equipment in this order is for procurement, installation, or commissioning of additional or similar equipment. Those facilities having a need to use nonstandard procedures for VDF installation will request waivers to applicable paragraphs of this order in order to continue to operate with justifiable variances. For explicit instructions pertaining to commissioning, operating, and maintaining nonstandard facilities see Order 6000.20B, Waiver of Criteria for Establishment and Maintenance of Airway Facilities. Requests for waivers submitted by facilities management personnel will be accompanied by all pertinent technical data necessary to define the problem and to justify the nonstandard equipment or operation requested. They will also include recommended solutions to the problem. Waivers already approved are still valid and do not require resubmission.

b. At existing facilities that are operationally acceptable, no wiring changes are to be made solely as a result of receiving this order. Existing waivers shall remain in effect as long as these facilities are considered operationally acceptable; however, whenever a facility undergoes modification, such as modernization, conversion, relocation, or equipment addition or removal, the standard set forth herein shall be followed.

c. Action shall be taken to budget for facility improvements which eliminate the need for waivers. Nonstandard facilities shall be upgraded to standard facilities within 5 years of the effective date of this order. The 5-year timeframe allows for the normal budget process. The regions have the responsibility to submit budget estimates to effect the upgrading of nonstandard facilities.

11. FLIGHT CHECK. It is the responsibility of the installation team to make all preparations for commissioning flight check. The facility should have been stabilized for at least 24 hours prior to flight-check time and all unsatisfactory conditions should have been corrected. Flight checks shall be accomplished as described in paragraph 95.

12.-19. RESERVED.

CHAPTER 2. SYSTEM DESCRIPTION

20. INTRODUCTION. The following paragraphs contain functional, physical, and operational descriptions of the FA-10121 VDF system. Figure 2-1 shows the equipment at the local site hereafter referred to as the antenna site, while figure 2-2 shows the equipment at the remote site hereafter referred to as the indicator site or Automated Flight Service Station (AFSS).

21. FA-10121 VDF FUNCTIONAL DESCRIPTION.

a. The FA-10121 VDF system is designed to operate over a frequency range of 118.000 to 136.975 MHz. The VDF equipment provides 760 channels spaced every 25 KHz with 10 preset channels available. The system is capable of receiving an aircraft transmission on one or more VDF antennas. Position information of the aircraft relative to other points of interest is presented graphically to the operator. The system provides intelligible audio from the aircraft to the operator. Information from VHF omnidirection range equipment (VOR) and pilot reports can be input to the system to aid in determining a position. The system is capable of Remote Maintenance Monitoring and Control (RMMC).

b. The system may include at most 24 VDF receivers connected to four operating positions. Each position operates independently of the others. The area of interest for the AFSS/Flight Service Station (FSS) VDF display is the geographical service area of the AFSS/FSS plus an additional 50 nautical miles beyond the AFSS/FSS boundary.

22. PHYSICAL DESCRIPTION. The FA-10121 VDF consists of seven major elements: the antenna assembly, the target antenna assembly, the receiver/processor group, the preamplifier/filter, the Information Display and Control Unit (IDCU), the battery changer power supply (BCPS), and the RMMC unit.

a. Antenna Assembly FA-10122. The FA-10122/1 VDF antenna is a 10-element Adcock array emanating from a central hub. The dipole housing and array element assembly mount on a 9.4 foot tubular mast with a flange for bolting onto a concrete pad or tower base. The flange is designed to fit on an existing FA-5530 VDF mount. A tower will be used to raise the antenna if close-in obstructions preclude line of sight to the horizon. Two standard single obstruction lights are provided. The entire antenna assembly is approximately 16.5 feet tall, 7.3 feet in overall diameter and weighs about 860 pounds. The FA-10122/2 antenna electronics unit is mounted at the base of the antenna in a waterproof enclosure.

FIGURE 2-1. FA-10121 VDF SYSTEM DIAGRAM (LOCAL SITE)

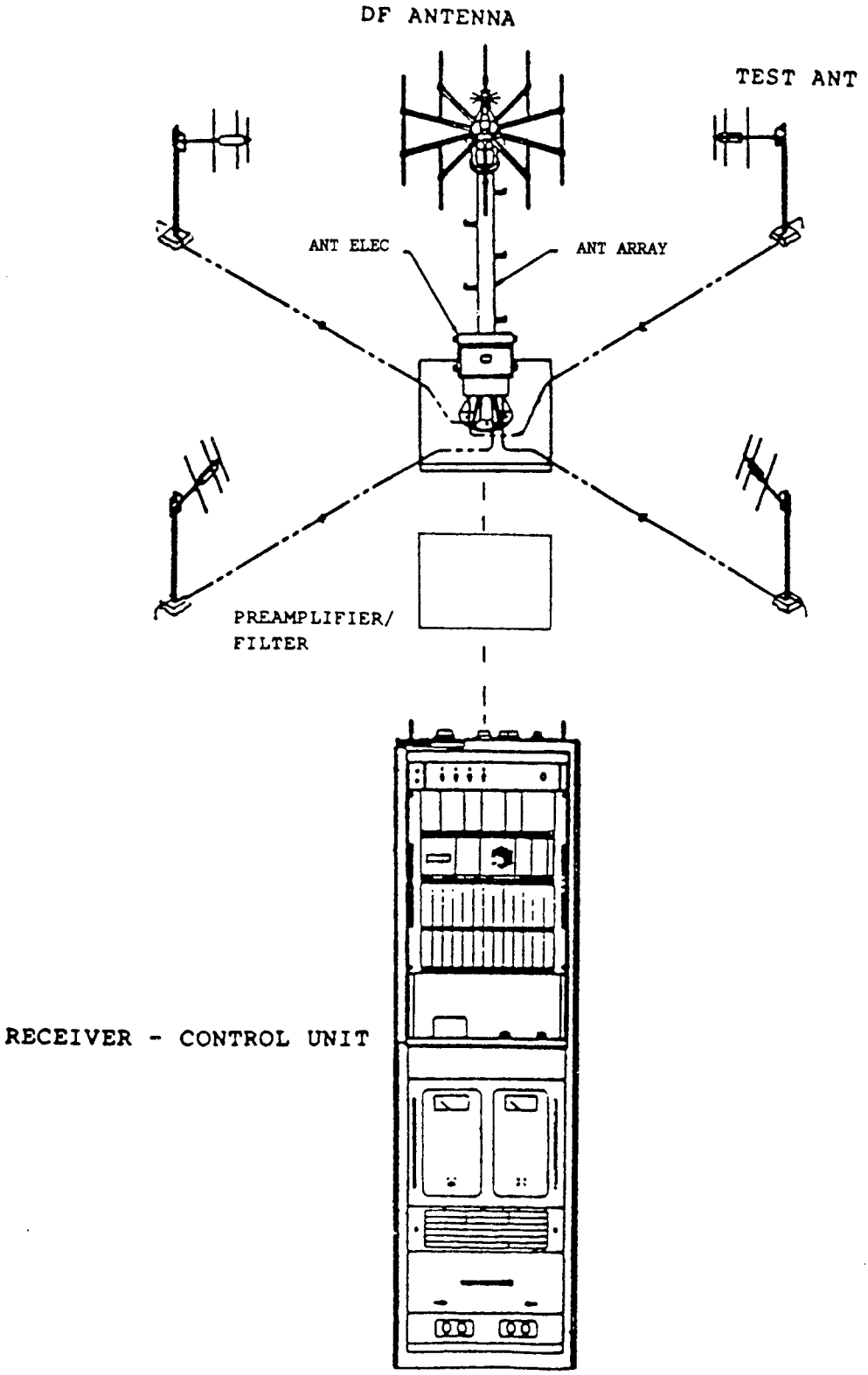
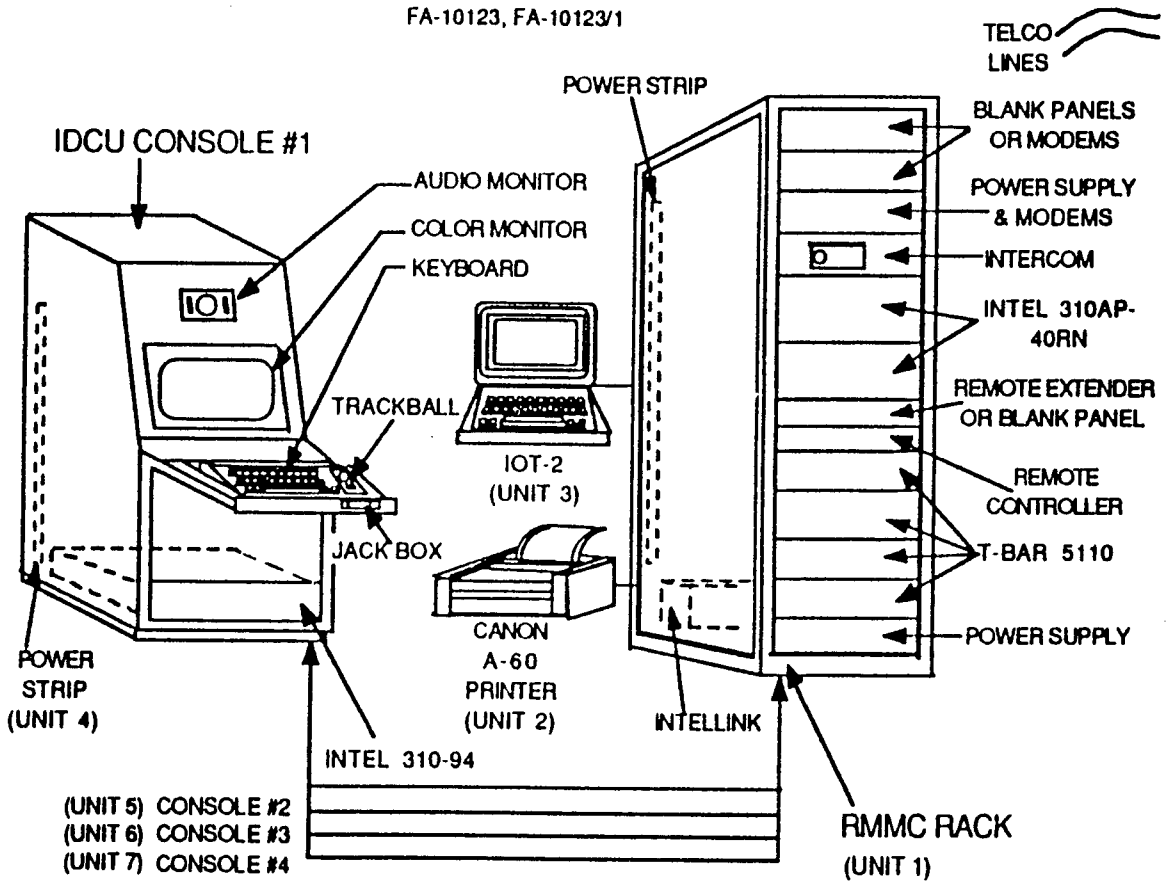


FIGURE 2-2. FA-10121 VDF SYSTEM DIAGRAM (REMOTE SITE)



b. Target Transmitter Assembly FA-10122/3. The VDF is normally equipped with four three-element yagi target antennas. Each antenna is mounted on an 8 foot aluminum pole. The target antennas are designed in accordance with FAA-G-2100 for wind and ice loading of environment III. An epoxy coating is applied to the aluminum poles in order to preclude electrochemical activity at the metal concrete interface. In cases where a full complement of target antennas are impractical because of space or other siting considerations then fewer than four target antennas may be used. If fewer than four antennas are used then system confidence will be decreased slightly. The normal antenna configuration utilizes four target antennas spaced 150 feet away from the main array. This distance is defined as the distance from the base of the main array to the base of the target antenna. The primary positions of the antennas are the mid-cardinal radials: 45, 135, 225, and 315 degrees. It is not required to use the mid-cardinal radials although it is the recommended configuration. At sites where the recommended mid-cardinal radials cannot be used, different radials are permitted within ± 20° at the intercardinal radials; but, in any event, the target antennas shall not be mounted at fractions of a degree or at even multiples of 18 degrees relative to the north dipole of the main array. The system can operate with less than four target antennas and ground checks can be completed with one or more target antennas. The target transmitter feeding the target antenna is located in the antenna electronics enclosure at the base of the main array. Unlike the FA-9964 this means lengthier cabling will be needed to carry test RF to the target antennas.

c. Preamplifier/Filter FA-10122/4. The preamplifier/filter is a three-section microprocessor-controlled resonant-cavity filter with a low noise amplifier. The preamplifier/filter is housed in a 65" x 34" x 13.5" aluminum box. It will be located at the antenna site not more than 2,000 feet in cable length from the main antenna array. It is intended to be collocated with the receiver/processor group. The aluminum box is weather sealed and semi-pressure sealed. Internal desiccant cylinders assure low humidity within the enclosure. Fasteners around the door seal the unit, forcing it to slowly "breathe" through a special air pressure equalizing valve. The preamplifier/filter can be bypassed by operator command from the maintenance keyboard IOT-2.

d. Receiver/Processor Group FA-10121. The receiver/processor group is installed in a rack at the antenna site not more than 2,000 feet in cable length from the main antenna array. Installed in the bottom of this rack is the BCPS FA-10121/2. The receiver/processor group consists largely of the VHF receiver, the bearing processor, the facility central processing unit (FCPU), a two-way voice intercom and a modem. The rack is divided into two sections with the upper section housing the receiver/processor group. This section is electromagnetic-interference (EMI) shielded. To maintain the EMI integrity of the rack, care must be exercised in its handling. The receiver/processor group draws about 5 amperes from the ac line.

e. Battery Charger Power Supply (BCPS) FA-10121/2. The BCPS is located in the lower portion of the receiver/processor group rack. The BCPS feeds dc power to the system and is able to charge a 24 volt bank of batteries if these

are used. All the system voltages to the receiver, filter, and antenna electronics are derived from the dc to dc converter. The converter's sole source of input is the BCPS 24 volt output.

f. Remote Maintenance Monitoring and Control (RMMC) FA-10123. This equipment is usually located in the equipment room at the AFSS. The RMMC is composed of two Intel computers with hard and floppy drives, a T-bar computer switch with power supply and modems linking the AFSS with antenna sites and with the maintenance processor subsystem (MPS) when available for the DF at the air route traffic control center (ARTCC). Additional modems will be installed in the RMMC rack in the AFSS to communicate with existing FA-9964 DF's. Ethernet cables carry data between the two FA-10123 computers and the computer in the lower section of the IDCU console. The RMMC is the system interface for maintenance actions taken at the IOT-2. A portable MDT, IOT-3, is available for field maintenance at the antenna site. The IOT-3 offers nearly all the same functions as the IOT-2 and a few special ones and is connected to the system via an RS-232 port on the receiver/processor group. The IOT-3 supplied with the project is a Compaq Portable III or equivalent.

g. Information Display and Control Unit (IDCU) FA-10123/1. The IDCU console, housed in the operations room at the AFSS/FSS, contains several components. The IDCU console contains the following: A Grim audio monitor, a 15-inch color graphics display monitor with keyboard, a trackball, and an Intel computer model 310-40. The equipment is normally located to the right of the AFSS's in-flight positions. The IDCU console is 25 inches wide and directly replaces the empty console now installed. Two consoles will be provided for each AFSS and one console for each FSS receiving DF equipment.

23. OPERATIONAL DESCRIPTION. The following subparagraphs give operational descriptions of the FA-10121 system units.

a. Antenna Assembly. The FA-10122 VDF antenna is a 10-element Adcock array. Unlike Doppler-effect DF's, no commutation diodes are located in the hub, giving the VDF system improved lightning handling capabilities and improved audio quality due the lack of commutative tone. Five pairs of dipoles are modulated by five different audio tones. These modulating tones permit the system to differentiate the RF phases of the five pairs. The five RF signals are fed to a combiner circuit in the antenna electronics box and routed via RG-333/U coaxial cable to the preamplifier/filter (if used) and the receiver/processor group. The VDF antenna is designed to have a voltage standing wave ratio (VSWR) of 1.2:1 or less at the mid-band frequency of 127.5 MHz and a VSWR of 1.5:1 or less over the total band of 118.000 to 136.975 MHz. The antenna is designed to supply an output of 3.5 microvolts across a 50 ohm load with an RF field strength of 10 microvolts/meter measured at the center of the VDF antenna array. A virtual sense antenna is formed by the action of a radial "top-hat" array and a down-sloping array of rods below it.

b. Target Transmitter Assembly. The VDF system is normally equipped with four three-element yagi target antennas. The antennas are used for system test to determine system bearing accuracy. The antennas are

keyboard controlled by the IOT-2 and are designed to provide a signal of 0.5 to 50 microvolts at the VDF receiver input. The antennas are automatically sequentially energized to determine bearing accuracy in each quadrant. The four target antennas must be present to pass the confidence and certification tests by automatic means. The antennas may be located no closer than 75 feet from a ground based main array FOR AN IDEAL SITE and it is strongly recommended that they be placed AT LEAST 100 FEET from the main array. The target antennas may not be placed further than 300 feet from a ground based main array.

NOTE: The regional Spectrum Management Office must conform to the Government Radio Spectrum Requirement to license all radio frequency transmitters by applying for licenses for all installed target transmitters. Specifications for the target antennas are included in Appendix 3.

c. Preamplifier/Filter. The preamplifier/filter is a three-section microprocessor controlled resonant cavity filter coupled with a low noise RF amplifier. The filter permits DF operations in relatively noisy signal environments without degradation of bearing accuracy. The filter tunes via microprocessor control in the 118.000 to 136.975 MHz frequency band in 25 KHz steps. Gain control is also accomplished by a microprocessor and adjusts from 0 to 20 dB in 1 dB steps. The filter has a narrow bandpass with response down 70 dB at 1 MHz from the center frequency. The VSWR of the filter is 1.2:1 at mid-band frequency and 1.5:1 over the frequency band. Tuning time is 500 milliseconds nominal. The RF signal from the preamplifier/filter is routed to the receiver processor group.

d. Receiver/Processor Group. The receiver/processor group provides a number of functions for the VDF system. The group receives the signal from the preamplifier/filter. The signal is demodulated and the bearing is determined. Bearing information is digitized and routed with the aircraft audio via voice/data modem on a TELCO circuit to the RMMC rack at the AFSS/FSS. Aircraft audio is also taken from the incoming signal. Receiver tuning is accomplished by a frequency synthesizer controlled by the IDCU or IOT-2. The receive frequency is displayed at both the receiver site on a Light Emitting Diode (LED) display and at the AFSS/FSS site on the IDCU's and IOT-2. The receiver has 10 frequency presets which are programmed using the IOT-1. Selection of the preset frequencies is by short form access (i.e., 1, 2, 3,...,10). Enter only the channel number and the frequency is automatically displayed. The receiver is designed to produce a clear audio output to a 600 ohm load with a 10 dB signal plus noise-to-noise ratio at the speaker terminals. This was determined using a VHF RF test voltage of 2.5 microvolts, 30 percent modulated with 1 KHz applied to the receiver input. Two audio outputs are provided. One is a standard speaker output in to an 8 ohm load. The second is the FCPU audio output and is adjustable for use at the VDF facility interface which is connected to a dedicated four-wire TELCO 3002 landline from -16 to 0 dBm into a 600 ohm load at the AFSS/FSS. The audio frequency response is between 300 and 3000 Hz.

e. BCPS. The BCPS is contained in the same rack as the receiver/processor group at the VDF site. The BCPS supplies dc power to the

dc to dc converter. The dc to dc converter modifies it and passes it to the preamplifier/filter, antenna electronics, and the receiver/processor group. The BCPS may be also used to charge a 24 volt bank of batteries. Six Globe CL4-575 lead calcium gel-electrolyte batteries connected in series are recommended in cold climates if the site requires batteries. The nominal system load is 351 watts or 14.6 amps at 24 volts dc. This load requires a battery capacity of 439 amp-hours to operate the system for 6 hours to the 50 percent discharged condition with allowances made for a 40 percent reduction in battery capacity at -40°C. Battery backup for the DF receiver equipment is determined by the regional authorities. In sites where frequent primary ac power outages occur, it is recommended to provide battery backup to the receiver equipment.

f. RMMC. The RMMC accepts the digitized bearing information from the receiver/processor group and readies it for display at the IDCU. Maintenance activities are initiated using the IOT-2 and keyboard. The following functions are accomplished by this system:

(1) Monitor equipment parameters.

(2) Monitor environmental parameters (optional by using an erasable Programmable Read Only Memory (PROM)).

(3) Perform periodic maintenance tasks.

(4) Perform certification tasks.

(5) Perform diagnostic testing to the lowest replaceable unit (LRU) level.

(6) Perform fault isolation to the LRU level.

(7) Remote control of specified equipment parameters and functions.

(8) Provide continuous monitoring of facility status.

(9) Provide two-way audio intercom between the RMMC and the receiver/processor group.

The functions listed in subparagraphs 23.f.(1)-(9) are accomplished and the results made available at the IOT-2 via an RS-232 interface. Data transmission format specified is bit oriented asynchronous ASCII coded characters. All monitoring and control functions are accomplished via dedicated landline where antenna and indicator are far apart geographically.

g. IDCU.

(1) The IDCU is located at the AFSS/FSS operations room adjacent to the in-flight positions. The IDCU presents aircraft information to the operator using a 15 inch color television monitor. A trackball is used to allow the operator to move a cursor across the monitor screen. The trackball has three push-button controls, allowing cursor change-of-speed, zoom-in and

zoom-out, and reciprocal bearing functions. The color monitor presents a map with graphics modeled after aviation type sectional-charts. The map is resident in the form of digital data on the hard drives of the computers. With each installation, government furnished map data is provided on floppy disc(s). The disc(s) will be retained at the site as a permanent record.

(2) A keyboard allows the flight AFSS specialist to manipulate the map and various information on the screen, to control the VDF system receiver frequencies, run certification and confidence tests on DF antennas, and to select incoming aircraft audio from as many as 24 DF antenna sites. The IDCU uses an Intel computer which is constantly in communication with the computers in the RMMC via an Ethernet hookup.

24.-29. RESERVED.

CHAPTER 3. INSTALLATION DRAWING PACKAGE

30. INTRODUCTION. The following installation drawings are to be adhered to when locating the FA-10121 VDF racks and its antenna, completing applicable interface wiring connections, and routing cable or conduit.

31. DRAWING SYNOPSIS. Drawings D-6217-1 and D-6217-2 from Order 6530.8, VHF/DF Installation Standards Handbook (Type FA-9964), are applicable for locating the FA-10121 equipment at existing VHF/DF VOR or VHF/DF air-ground communications installations sites except that the communications rack is eliminated and replaced by the receiver bearing processor group. Additionally, space is required for the preamplifier/filter unit. The commutation cable is eliminated and replaced with the built-in test equipment (BITE) test cable. Additionally, antenna control and dc power cables are routed to the antenna.

a. Figure 3-1 is the wiring diagram for the remote site (AFSS). Figure 3-3 is the wiring diagram for the local site (receiver) which probably will be at a VHF/DF VOR or VHF/DF air-ground communications installation.

b. Figure 3-2 presents a connection diagram for the remote site showing relative equipment positions and cable jacks.

c. Figure 3-4 presents a typical AFSS console.

d. Figure 3-5 presents typical antenna foundation details.

e. Figure 3-6 is for construction of the battery simulator cable to be used when batteries are not a part of the installation.

f. Figure 3-7 is for construction of the IDCU Ethernet cables.

g. Figure 5-1 presents the target antenna installation.

h. Appendix 1 contains the local site installation wirelist.

i. Appendix 2 contains the remote site installation wirelist.

32.-39. RESERVED.

DESIGNATION	P1 CONNECTOR	BACKSHELL	P2 CONNECTOR	BACKSHELL	CABLE (GFE)	FUNCTION	REMARKS	DRWG#
RW2	205208-1 (AMP)	1-206478-2	205208-1 (AMP)	1-206478-2	9614 Beldon	IOT-2 to Comp.B	24 AWG, 9 Cond., DB-25, Male to Male	2001202
RW3	205208-1 (AMP)	1-206478-2	205208-1 (AMP)	1-206478-2	9614 Beldon	Printer to RMMC	24 AWG, 9 Cond., DB-25, Male to Male	2001202
RW1	205208-1 (AMP)	1-206478-2	205207-1 (AMP)	1-206478-2	9614 Beldon	IOT-2 to Comp.A	24 AWG, 9 Cond., DB-25, Male to Female	2001201
RW4,RW5	205205-2 (AMP)	745172-2	205206-1 (AMP)	745172 1	G-0007 TCL	Ethernet	4,22 pr & grnd DB-15, Female to Male Locking post & slide latch 20614, 745583-5	2001204
RW17	#6 LUGS	N/A	480318-0 (AMP)	N/A	3241 Alpha	DC Power	18 AWG, 2 Cond., Lugs to Molex	2001206
RW13	205208-1 (AMP)	1-206478-2	205208-1 (AMP)	1-206478-2	9614 Beldon	Audio/Control	24 AWG, 9 Cond., DB-25, Male to Male	2001205
RW18	480318-0 (AMP)	N/A	480318-0 (AMP)	N/A	3241 Alpha	DC Power	18 AWG, 2 Cond., Molex 4 to Molex 2	2001207
RW8	552032-1 (AMP)	4-552008-1	229975-1 (AMP)	4-552008-1	5480/25 Alpha	Pilot Audio	AMP Champ, Male to Female	2001203
RW10	552032-1 (AMP)	4-552008-1	229975-1 (AMP)	4-552008-1	5480/25 Alpha	Pilot Audio	AMP Champ, Male to Female	2001203
RW14	205208-1 (AMP)	1-206478-2	205208-1 (AMP)	1-206478-2	9614 Beldon	Audio/Control	24 AWG, 9 Cond., DB-25, Male to Male	2001205
RW2	Telco Block	N/A	MS3476L10-6S	MS5049/52-110A	5902 Alpha	4 Wire Telco	24 AWG Solid, 4 Cond., Shielded	2001208
2W1,1W26,3W1 4W12,5W12		N/A		N/A		AC Power	Supplied with Units 1 thru 4	

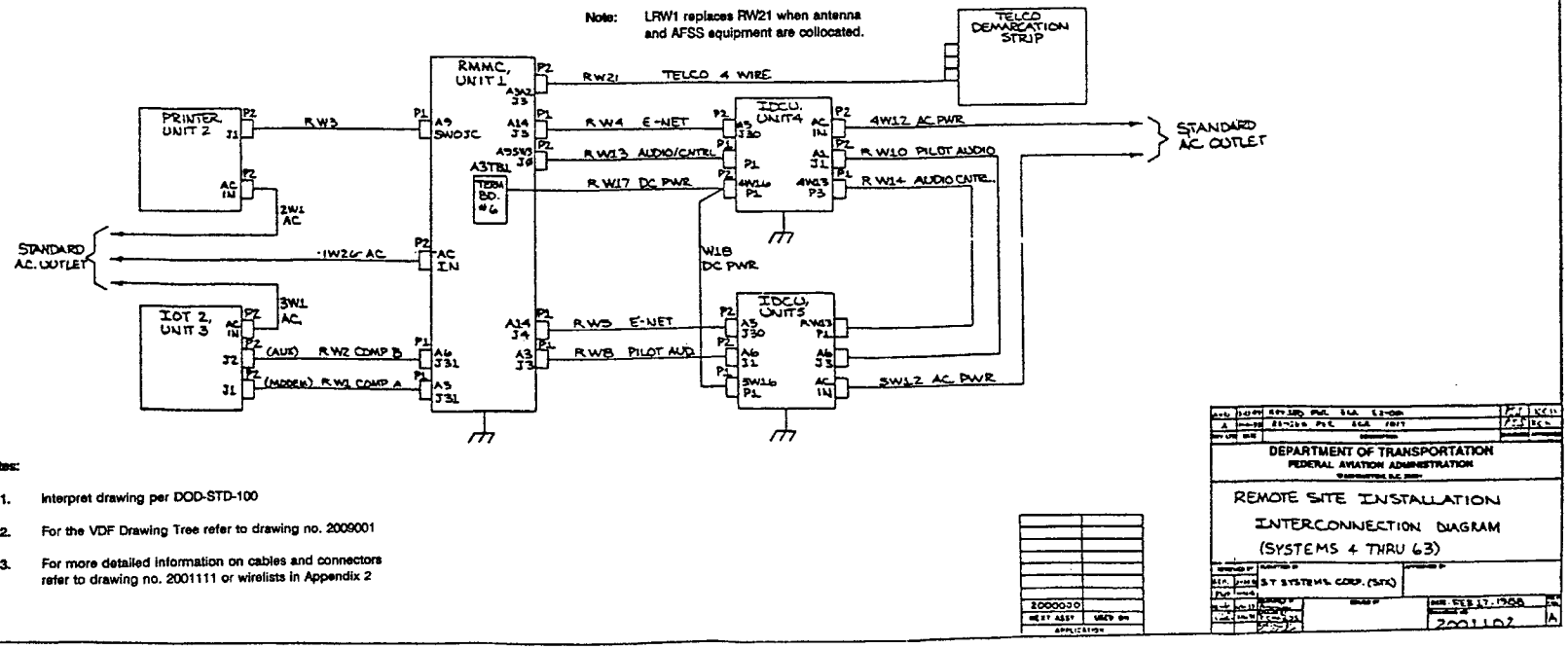


FIGURE 3-1. REMOTE SITE (AFSS) INTERUNIT WIRING DIAGRAM

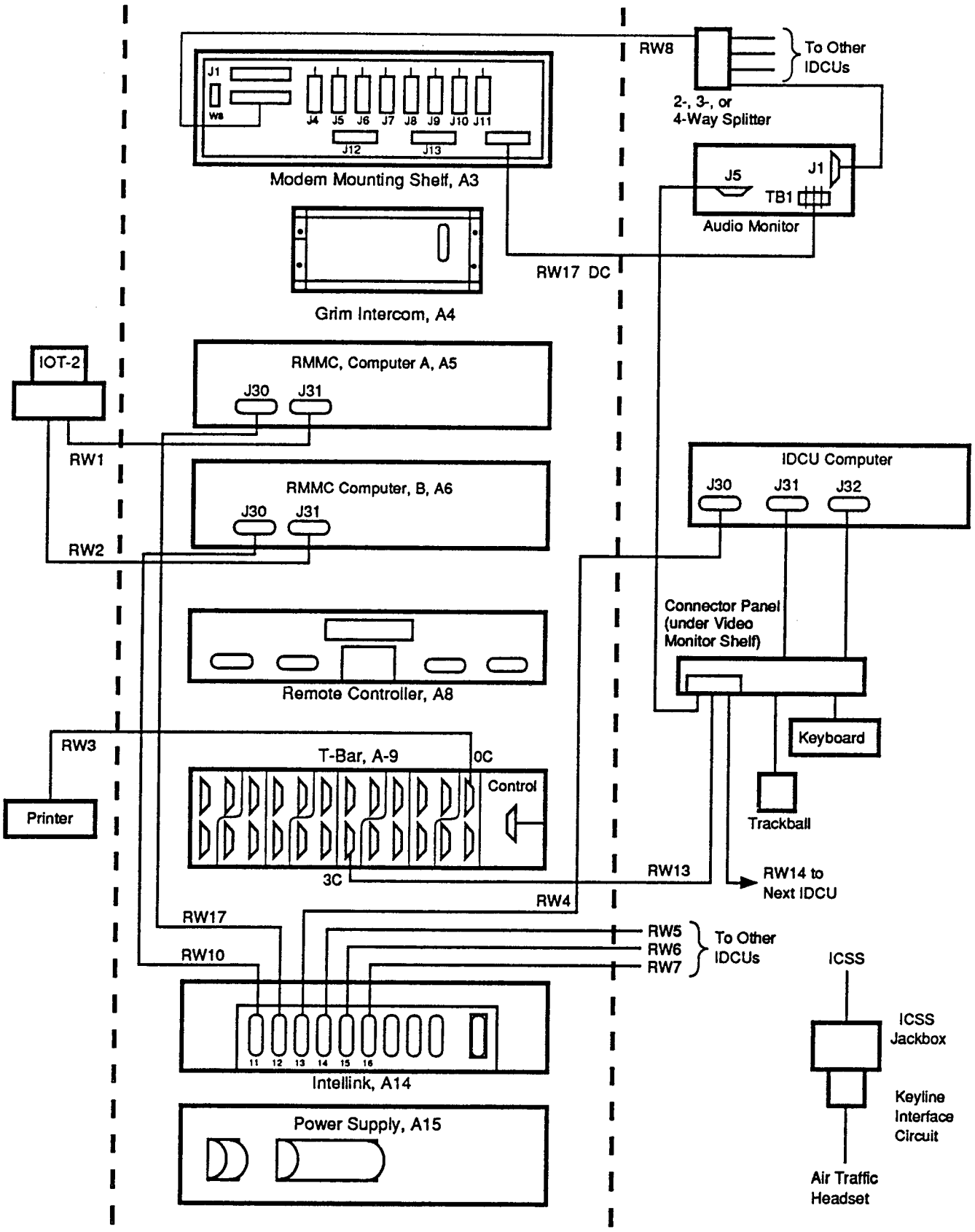
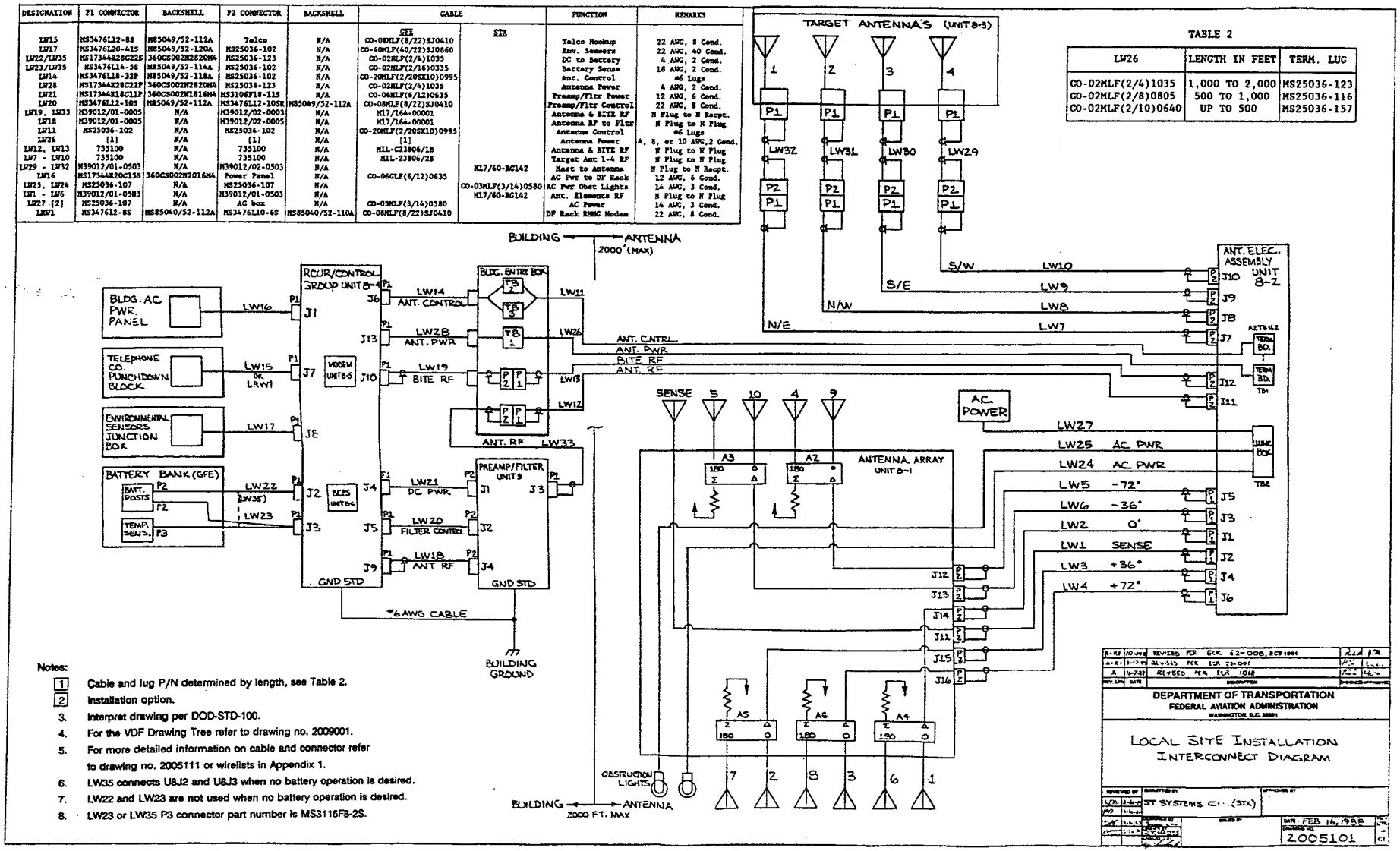


FIGURE 3-2. REMOTE SITE CONNECTION DIAGRAM

DESIGNATION	P1 CONNECTOR	BACKSHELL	P2 CONNECTOR	BACKSHELL	CABLE GFE	CABLE STK	FUNCTION	REMARKS
LW15	MS3476L12-8S	M85049/52-112A	Telco	N/A	CO-08MLF(8/22)SJ0410		Telco Hookup	22 AWG, 8 Cond.
LW17	MS3476L20-41S	M85049/52-120A	MS25036-102	N/A	CO-40MLF(40/22)SJ0860		Env. Sensors	22 AWG, 40 Cond.
LW22/LW35	MS1734A28C22S	360CS002M2820M4	MS25036-123	N/A	CO-02MLF(2/4)1035		DC to Battery	4 AWG, 2 Cond.
LW23/LW35	MS3476L14-5S	M85049/52-114A	MS25036-102	N/A	CO-02MLF(2/16)0335		Battery Sense	16 AWG, 2 Cond.
LW14	MS3476L18-32P	M85049/52-118A	MS25036-102	N/A	CO-20MLF(2/20SX10)0995		Ant. Control	#6 Lugs
LW28	MS1734A28C22P	360CS002M2820M4	MS25036-123	N/A	CO-02MLF(2/4)1035		Antenna Power	4 AWG, 2 Cond.
LW21	MS1734A18C11P	360CS002M1816M4	MS3106F18-11S	N/A	CO-04MLF(6/12)0635		Preamp/Filtr Power	12 AWG, 6 Cond.
LW20	MS3476L12-10S	M85049/52-112A	MS3476L12-10SR	M85049/52-112A	CO-08MLF(8/22)SJ0410		Preamp/Filtr Control	22 AWG, 8 Cond.
LW19, LW33	M39012/01-0005	N/A	M39012/02-0003	N/A	M17/164-00001		Antenna & BITE RF	N Plug to N Recpt.
LW18	M39012/01-0005	N/A	M39012/02-0005	N/A	M17/164-00001		Antenna RF to Filtr	N Plug to N Plug
LW11	MS25036-102	N/A	MS25036-102	N/A	CO-20MLF(2/20SX10)0995		Antenna Control	#6 Lugs
LW26	[1]	N/A	[1]	N/A	[1]		Antenna Power	4, 8, or 10 AWG, 2 Cond.
LW12, LW13	735100	N/A	735100	N/A	MIL-C23806/18		Antenna & BITE RF	N Plug to N Plug
LW7 - LW10	735100	N/A	735100	N/A	MIL-23806/28		Target Ant 1-4 RF	N Plug to N Plug
LW29 - LW32	M39012/01-0503	N/A	M39012/02-0503	N/A		M17/60-RG142	Mast to Antenna	N Plug to N Recpt.
LW16	MS1734A20C15S	360CS002M2016M4	Power Panel	N/A	CO-06GLF(6/12)0635		AC Pwr to DF Rack	12 AWG, 6 Cond.
LW25, LW24	MS25036-107	N/A	MS25036-107	N/A		CO-03MLF(3/14)0580	AC Pwr Obst Lights	14 AWG, 3 Cond.
LW1 - LW6	M39012/01-0503	N/A	M39012/01-0503	N/A		M17/60-RG142	Ant. Elements RF	N Plug to N Plug
LW27 [2]	MS25036-107	N/A	AC box	N/A	CO-03MLF(3/14)0580		AC Power	14 AWG, 3 Cond.
LW31	MS3476L12-8S	MS85040/52-112A	MS3476L10-6S	MS85040/52-110A	CO-08MLF(8/22)SJ0410		DF Rack RMNC Modem	22 AWG, 8 Cond.

TABLE 2

LW26	LENGTH IN FEET	TERM. LUG
CO-02MLF(2/4)1035	1,000 TO 2,000	MS25036-123
CO-02MLF(2/8)0805	500 TO 1,000	MS25036-116
CO-02MLF(2/10)0640	UP TO 500	MS25036-157



Notes:

1. Cable and lug P/N determined by length, see Table 2.
2. Installation option.
3. Interpret drawing per DOD-STD-100.
4. For the VDF Drawing Tree refer to drawing no. 2009001.
5. For more detailed information on cable and connector refer to drawing no. 2005111 or wirelists in Appendix 1.
6. LW35 connects U8J2 and U8J3 when no battery operation is desired.
7. LW22 and LW23 are not used when no battery operation is desired.
8. LW23 or LW35 P3 connector part number is MS3116F8-2S.

FIGURE 3-3. LOCAL SITE (RECEIVER) INTERUNIT WIRING DIAGRAM

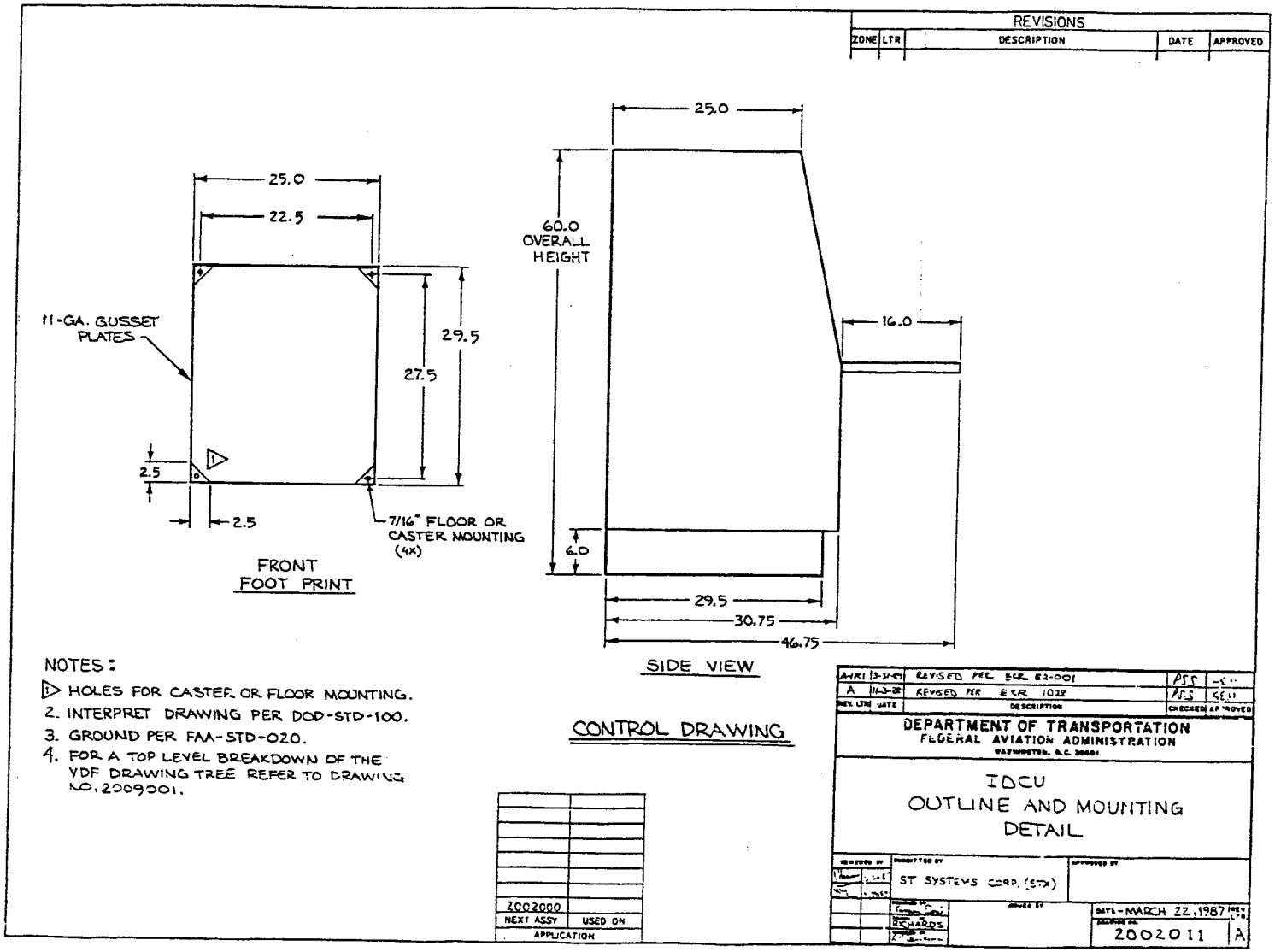
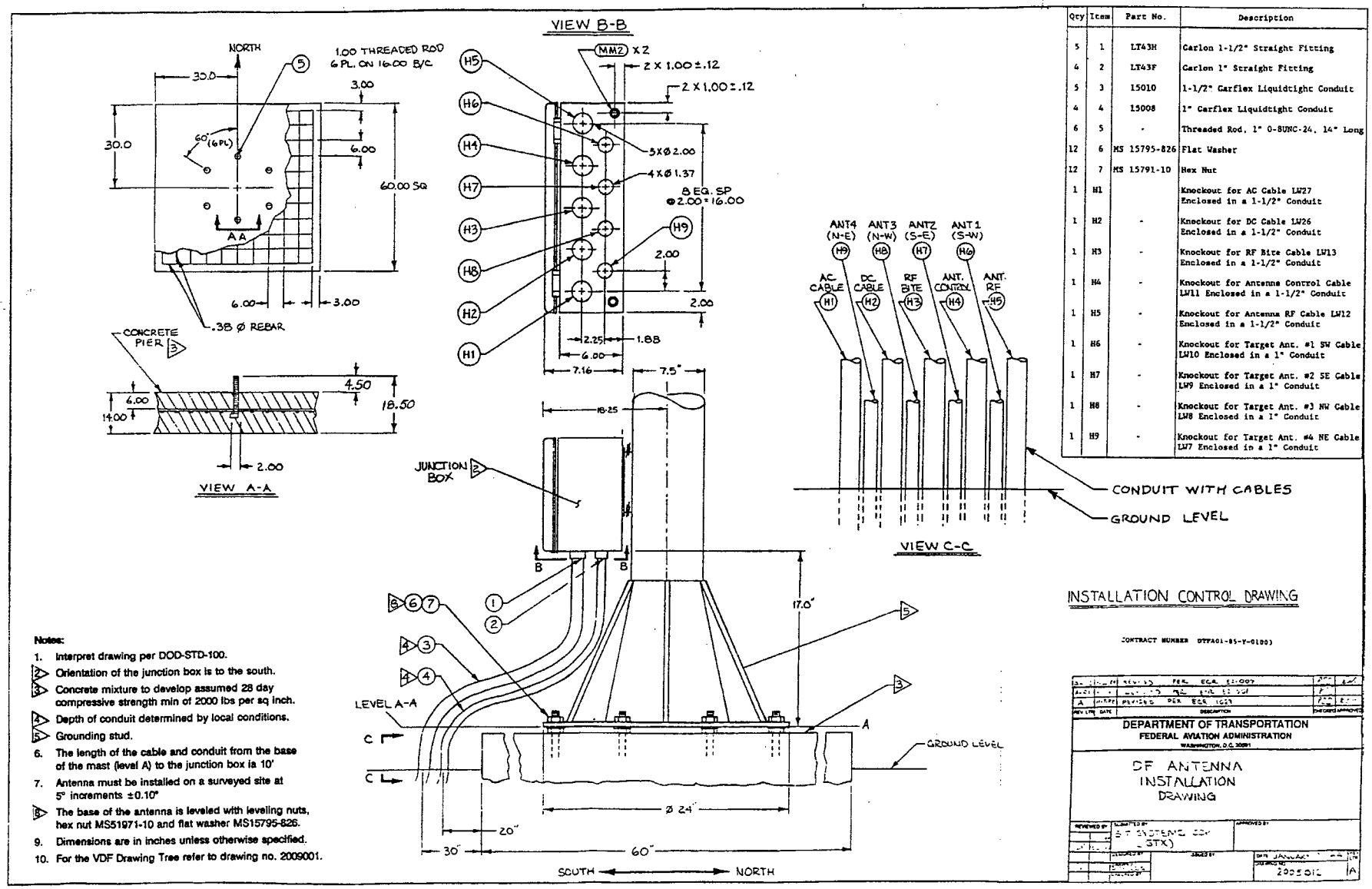


FIGURE 3-4. TYPICAL AFSS CONSOLE



Qty	Item	Part No.	Description
5	1	LT43H	Carlon 1-1/2" Straight Fitting
4	2	LT43F	Carlon 1" Straight Fitting
5	3	15010	1-1/2" Carflex Liquidtight Conduit
4	4	15008	1" Carflex Liquidtight Conduit
6	5	-	Threaded Rod, 1" 0-8UNC-24, 14" Long
12	6	MS 15795-826	Flat Washer
12	7	MS 15791-10	Hex Nut
1	H1		Knockout for AC Cable LW27 Enclosed in a 1-1/2" Conduit
1	H2	-	Knockout for DC Cable LW26 Enclosed in a 1-1/2" Conduit
1	H3	-	Knockout for RF Bite Cable LW13 Enclosed in a 1-1/2" Conduit
1	H4	-	Knockout for Antenna Control Cable LW11 Enclosed in a 1-1/2" Conduit
1	H5	-	Knockout for Antenna RF Cable LW12 Enclosed in a 1-1/2" Conduit
1	H6	-	Knockout for Target Ant. #1 SW Cable LW10 Enclosed in a 1" Conduit
1	H7	-	Knockout for Target Ant. #2 SE Cable LW9 Enclosed in a 1" Conduit
1	H8	-	Knockout for Target Ant. #3 NW Cable LW8 Enclosed in a 1" Conduit
1	H9	-	Knockout for Target Ant. #4 NE Cable LW7 Enclosed in a 1" Conduit

Notes:

1. Interpret drawing per DOD-STD-100.
2. Orientation of the junction box is to the south.
3. Concrete mixture to develop assumed 28 day compressive strength min of 2000 lbs per sq inch.
4. Depth of conduit determined by local conditions.
5. Grounding stud.
6. The length of the cable and conduit from the base of the mast (level A) to the junction box is 10'
7. Antenna must be installed on a surveyed site at 5° increments ±0.10"
8. The base of the antenna is leveled with leveling nuts, hex nut MS51971-10 and flat washer MS15795-826.
9. Dimensions are in inches unless otherwise specified.
10. For the VDF Drawing Tree refer to drawing no. 2009001.

INSTALLATION CONTROL DRAWING

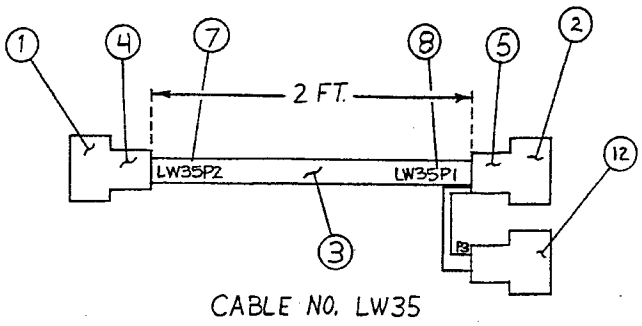
CONTRACT NUMBER DTFA01-85-Y-01001

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

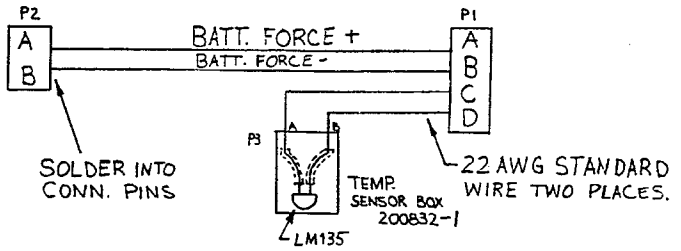
DF ANTENNA INSTALLATION DRAWING

2005012 A

FIGURE 3-5. VDF ANTENNA FOUNDATION DETAILS



CABLE NO. LW35



CONTRACT NUMBER DTFA01-85-Y-01003

REV. LTR	DATE	DESCRIPTION	CHECKED	APPROVED
A+R1	4-1-89	REVISED PER ECR E2-001	PSS	
A	11-8-88	REVISED PER ECR 1013	PSS	

Notes:

1. Connector part no. Bayonet M17344R28C22S
2. Connector part no. Bayonet MS3476L14-5S
3. Cable type CO-02MLF(2/16)0335
4. Back shell part no. 360CS002N2820M4
5. Back shell part no. M85049/52-1-14N
6. For detail information refer to drawing no. 2005111
7. 8. PANDUIT PSWMS-1015 Cable Marker or approved equivalent
9. For the VDF Drawing Tree refer to drawing no. 2009001
10. Interpret drawing in accordance with DOD-STD-100
11. Workmanship in accordance with requirement 9 of MIL-STD-454
12. Connector part no. MS3106F18-11S

2005101	
NEXT ASSY	USED ON
APPLICATION	

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

BATTERY SIMULATOR
CABLE ASSEMBLY

REVIEWED BY	SUBMITTED BY	APPROVED BY
KC 5/31/88	ST SYSTEMS CORP. (STX)	
GMF 5/31/88		

DESIGNED BY
DRAWN BY RICHARDS
CHECKED BY
ISSUED BY
DATE 5-28-88
DRAWING NO. 2005205
REV A

FIGURE 3-6. BATTERY SIMULATOR

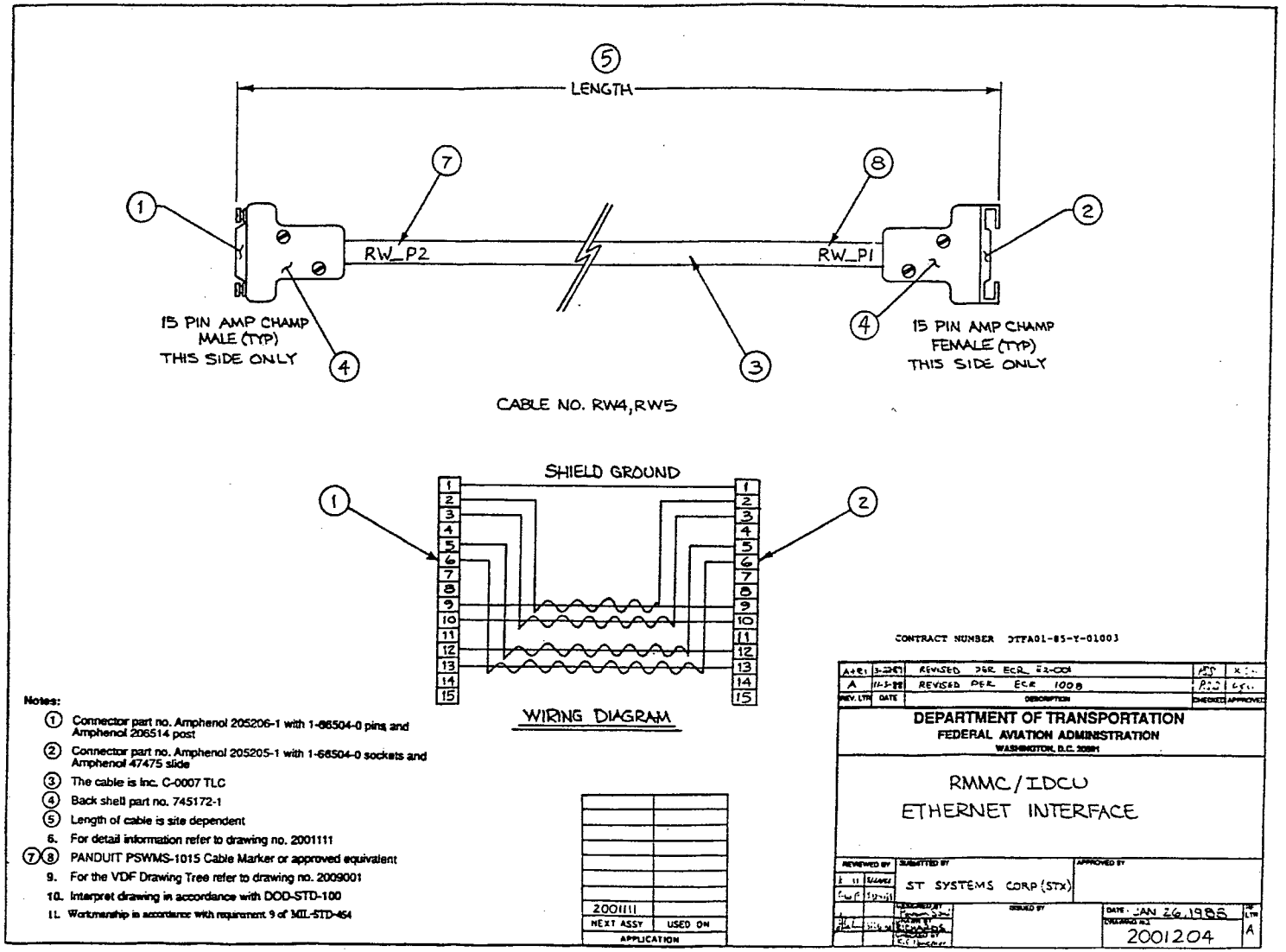


FIGURE 3-7. RMMC/IDCU ETHERNET INTERFACE

CHAPTER 4. INSTALLATION GUIDANCE

40. INTRODUCTION. This chapter documents a step-by-step procedure for installing the FA-10121 equipment and its antenna.

41. REGIONAL RESPONSIBILITIES FOR INSTALLATION. The regions will be installing the modernized DF. The following paragraphs describe site preparation before the equipment arrives at the site.

a. Construction of Main Array Antenna Base. Obstruction light power, RF, BITE test, 12-pair control cable, and dc power cabling must be constructed and in place. The regions shall supply the two 100-watt obstruction light bulbs at time of antenna emplacement. The antenna site will be surveyed with the determination of points referenced to true north in 5-degree increments ±.1 degree 150 feet from the main array. Local site cable wirelists are contained in appendix 1 and remote site cable wirelists are contained in appendix 2.

b. Construction of Target Antenna Bases. Target antenna bases must be constructed for each target antenna to be installed. Co-axial cables, conduits, and junction boxes must be installed. The target antenna masts must be onsite prior to site preparation.

c. Provision for Circuit Breakers and Electrical Outlets. Before installation of the racks, 20 amp circuit breakers dedicated to each individual rack and appropriately labeled, shall be in place. At a typical AFSS two breakers will be needed by the two IDCU consoles. A third breaker will be required for the RMMC equipment installed in the equipment room. At the local site two circuit breakers are required for the receiver/processor rack. One 30 amp circuit breaker is required for the BCPS, and one 20 amp circuit breaker is required for an ac outlet in the rack. The receiver/processor rack must be within 2,000 feet in cable length of the main array.

d. Location of the IDCU. The IDCU or graphics monitor is the flight service specialist's man-to-machine interface. It is located at the AFSS/FSS and communicates with the computers housed in the RMMC rack. The usual AFSS facility will have two of these, located beside the in-flight positions. The FSS's will usually have but one due to their limited floor space. The regions shall provide space for the two IDCU 25 inch-wide consoles next to the in-flight positions. In many cases additional equipment has been installed in the existing DF indicator consoles. The VDF consoles have no space for this additional equipment and the regions should have a scheme for its relocation. In some stations the FA-5530, FA-9964, and FA-10122 will need to co-exist for an interval.

e. Allocation of Floor Space. Floor space must be allocated for all the racks mentioned in subparagraph c and for the FA-10122/4 preamplifier/filter. Mounting holes will be drilled and rack hold-down hardware supplied. Cableways shall be available for interrack wiring and the wire or cable made

available at the time of installation as Government furnished equipment (GFE). Twelve inches of clearance must be available above the receiver/processor rack between the overhead cableways or conduits.

f. Electrical Wiring and TELCO Line Installation. The regions are responsible for installing the ac electrical wiring and TELCO lines. The IDCU will have a duplex electrical outlet in its rack. The TELCO circuits connect to a dedicated four-wire 3002 landline with a nominal data rate of 300 baud. Audio on this line is adjustable for use at the VDF facility from -16 dBm to 0 dBm into a 600 ohm load.

g. Environmental Parameter Reporting. The Modernized Direction Finder has the capability to report on a large variety of environmental variables: ac line voltage, building temperature, intrusion alarm, etc. This function is site selective by programming an erasable PROM onsite to configure the VDF system for the sensors needed. The programming will be accomplished by site maintenance personnel.

h. Procuring Batteries. Six Globe XL4-575 lead calcium gel-electrolyte batteries connected in series are required for sites needing batteries. Regions will procure batteries from the FAA Logistics Center via standard FAA procurement procedures. If batteries are not used, temperature sensor LM135 is connected across U8J2 and U8J3. Cables LW22 and LW23 are not used if batteries are not used, instead cable LW35 is used (see figure 3-6).

i. Ground Checks. At sites with less than four target antennas, ground checks will be conducted as in the past with DF's by using a signal source on known radials.

j. Decommissioning FA-5530's. At sites where FA-5530 DFs will be decommissioned, the regions will coordinate with the FAA Logistics Center (AML-600) for the disposition of the removed equipment. The decommissioned FA-5530s will be used by the FAA Logistics Center to meet critical support requirements for the remaining FA-5530s in the field.

42. INSTALLATION PROCEDURE. Table 4-1 contains a step-by-step procedure for installing the FA-10121 VDF equipment. This table is similar to table 4-1 in Order 6530.8 and contains changes for the FA-10121 VDF. Specific installation procedures for the various equipment are contained in chapter 5. These procedures with their associated figures and tables must be adhered to for correct installation of the equipment. Site drawings from chapter 3 of Order 6530.8 are to be used as a guide for locating the equipment at existing sites (VOR/VHF/DF), keeping in mind the requirement for additional space and the changes outlined in chapter 3 of this order due to the installation of the new equipment.

43.-49. RESERVED.

TABLE 4-1. VHF/DF INSTALLATION PROCEDURE

Task	Definition	Standards	Comments/Notes
1	Unpack, inspect, and inventory the VDF, its antenna and ancillary items.	Paragraph 51, General	Table 5-1, Equipment and Accessories Supplied. Table 5-2, Cables Required but Not Supplied.
	Unpacking and re-packing.	Subparagraph 51a	Table 5-3, Hardware Required but not Supplied.
	Check equipment supplied.	Subparagraph 51b	
	Damaged equipment.	Subparagraph 51c	Do not roll antenna, lift it and carry it after unpacking.
	Visual inspection.	Subparagraph 51d	
2	VDF VOR Installations.		Chapter 5, Section 4, Paragraph 69.
	If alternate type cables (NOT DIRECT BURIAL) are used, install type DB PVC conduits between enclosure and antenna mast.		
	Route power cable (obstruction light) antenna signal cables (RF, BITE test and target transmitter cables) in trench or PVC conduit, Type DB as required.		
	In routing of cables a spacing of no less than 8 inches is required between power cables and other cables.		

TABLE 4-1. (cont.)

Task	Definition	Standards	Comments/Notes
2 concl.	Route power cable (receiver/bearing processor) to distribution panel.		
	Route other cables inside enclosure as required by enclosure layout.		
3	VDF, VHF/UHF Communication Facility Facility Wiring and Installations.	Chapter 5, Section 2, Wiring and Cabling	Chapter 3, figure 3-3.
	If alternate type cables (NOT DIRECT BURIAL) are used, install PVC Type DB conduits from enclosure to antenna mast.	Chapter 5, Section 3, Grounding, Shielding, and Bonding	
	Route power cable (obstruction light, if required) and antenna signal cables (RF, BITE test and target transmitter cables) in trench or PVC conduit, Type DB, as required.		All cables to and from the receiver/bearing processor shall be routed via top panel openings.
	Route power cable (receiver/bearing processor) to distribution panel.		Lightning and surge protection on power lines per FAA-STD-019a

TABLE 4-1. (cont.)

Task	Definition	Standards	Comments/Notes
3 concl.	Route other cables inside enclosure as required by enclosure layout.		Once the power cables have been wired to the power distribution panel, appropriate safety precautions shall be taken to prevent energizing the VDF. The VDF shall not be energized until the installation is completed. The VDF shall be energized in accordance with the VDF Manufacturers Technical Instruction (TI) Manuals. (TI 6530.10 and TI 6530.11).
4	Mount VDF antenna and mast at site.	Paragraph 53, Antenna Assembly	Antenna mast foundation shall be prepared in advance of VDF installation in accordance with FAA drawings and the antenna tower construction standard FAA-C-2621a.
	Route cables through mast to antenna.		Drawings in Order 6530.8 are not applicable for FA-10121 bolt pattern.
	Assemble appropriate connectors to VDF antenna.		Figure 3-3, Local Site Interunit Wiring Diagram.
5	Unpack and inspect the target transmitter and target antennas.	Paragraph 51 General	Table 5-1, Equipment and Accessories Supplied.

TABLE 4-1. (cont.)

Task	Definition	Standards	Comments/Notes
5 concl.			Table 5-2, Cables Required but not supplied.
	Mount and connect target transmitter assembly and four target antennas.	Paragraph 55, Target Transmitter Assembly	Figures 5-1 and 5-8, Target Antenna Installation and Mounting Plate.
6	Install the preamplifier/filter assembly.	Paragraph 57, Preamplifier/ Filter Unit Assembly	Table 5-1, Equipment and Accessories Supplied.
7	Install the receiver/processor group	Paragraph 56, Receiver and Bearing Processor Unit Assembly	Table 5-1, Equipment and Accessories Supplied.
8	Install IDCU	Paragraph 59, IDCU Assembly Installation	IDCU assembly shall be installed in a console at the FSS/AFSS facility. Figure 5-1.
9	Install RMMC Unit	Paragraph 60, RMMC Assembly	Table 5-1, Equipment and Accessories Supplied.

CHAPTER 5. INSTALLATION STANDARDS

SECTION 1. EQUIPMENT INSTALLATION

50. INTRODUCTION. This section contains specific installation procedures for the FA-10121 VDF equipment. The material presented in this section is similar to chapter 5, section 1 of Order 6530.8.

51. GENERAL VHF/DF EQUIPMENTS.

a. Unpacking and Repacking. The FA-10121 VDF is shipped in separate containers. Table 5-1 lists the contents of each container and should be used to check the bill of materials and the actual shipments. Care should be taken in unpacking the equipment to avoid damage, especially when handling the T shaped dipole arms due to the fragility of the nylon insulating connectors holding the short dipoles into the longer support arm. It is recommended that packing for reshipment be accomplished by using the same containers and cushioning fillers with which the equipment was originally packed. If these materials are unavailable, care should be taken to provide adequate cushioning and shipping containers, as required by specification MIL-E-17555. After opening the shipping containers and removing the cushioning fillers, perform subparagraphs 51b through 51d in sequence.

b. Check Equipment Supplied. Equipment will be shipped to both the antenna site and AFSS/FSS. Check the contents of each container to ensure that the FA-10121 VDF system is complete. Table 5-1 lists the contents of each container and its shipping location (antenna or AFSS/FSS). Table 5-2 lists the cables required but not supplied. Table 5-3 lists the hardware required but not supplied. Equivalent cables and connectors from various manufacturers may be used.

c. Damaged Equipment. Examine the contents of the containers for signs of shipping damage. Particularly, check to see if the containers show signs of mishandling. If any equipment is found to be damaged, no attempt should be made to remove, install, or operate it. Inform the carrier as to the nature of the damage before returning the equipment to the factory.

d. Visual Inspection. After opening all the containers, removing all packing materials or interior restraints, and checking for shipping damage the FA-10121 VDF units are ready to be moved onto a flat, clean surface for a thorough inspection.

e. FA-9964 Interface. At sites where the FA-10121 VDF equipment will be interfaced with the FA-9964 receiver/processor equipment, special Grim modems model # IVDM-101L will be supplied with the RMMC equipment to the AFSS. This modem is physically and functionally compatible with the IVDM-4W/C modems and occupies the same space as does the IVDM-4W/C. The IVDM-101L uses the same cabling as does the IVDM-4W/C. The only differences between the modems are the baud rate and the frequency of the frequency shift keying (FSK).

52. INSTALLATION PROCEDURES. Installation procedures for the FA-10121 VDF system are provided in paragraphs 53 to 60.

TABLE 5-1. EQUIPMENT AND ACCESSORIES SUPPLIED

Local Site

Nomenclature	FAA Number	Dimensions Crated	Weights	Notes
1. Receiver Processor Group	FA 10121	83 in. high 22 in. wide 26 in. deep	625 lbs.	Includes 1 Grim modem IVDM-4W/E
2. Antenna Electronics	FA 10122/2	44 in. high 34 in. wide 24 in. deep	186 lbs.	
3. Antenna Mast	FA 10122/1	151 in. long 34 in. wide 22 in. high	494 lbs.	
4. Antenna Array	FA 10122	60 in. long 33 in high 38 in. wide	178 lbs.	
5. Test Antenna	FA 10122/3	71 in. high 55 in. wide 28 in. deep	34 lbs.	System includes 4 test antennas
6. Connectors/Misc.		24 in. high 24 in. wide 24 in. deep	40 lbs.	Includes connectors and hardware for construction of inter unit cables
7. Preamplifier/Filter	FA 10122/4	67 in. high 37 in. wide 22 in. deep	264 lbs.	Includes 3 hexhead drivers: 1/4", 7/64", and 5/32"
8. Preamplifier/Filter Installation Hardware		4 in. high 4 in. wide 4 in. deep	1 lb.	4 lock/bolts
9. Compaq Portable III (IOT-3)				Availability based on regional demand

All intra-unit cabling and hardware are provided by the contractor. Interunit cabling must be procured and built using the contractor supplied connectors.

TABLE 5-1. (cont.)

Remote Site

Equipment	Nomenclature	Quantity	Dimensions (inches) width	height	depth
RMMC Microcomputer	310AP40RN	2	17.0	6.5	21.0
Voice/Data Modem	GRIM IVDM-4W/C	1	2.25	7.0	13.5
Power Supply/Mounting Shelf	GRIM MMS-102	1	19.0	8.75	19.0
Intercom Mounting Panel	18267-2	1	19.0	5.25	0.12
Intercom	GRIM AIS-8D/24	1	19.0	7.0	7.25
Audio Monitor	GRIM AMS-8M/24	2	9.0	6.5	7.25
Switching Assembly	T-BAR 5110	1	19.0	5.25	7.25
ASCII Remote Controller	T-BAR 4990-21	1	19.0	1.75	17.5
Power Supply	T-BAR 5997	1	19.0	5.25	6.0
Intellink Module	Intel IDCM 911-1	1	14.0	7.5	5.5
Monitor (IOT-2)	B.NK P/O HDS-2000	1	14.0	14.0	13.0
Keyboard (IOT-2)	85-1A P/O HDS-2000	1	18.0	1.5	6.5
RMMC Keytops (kit)	2003031 (STX drawing #)	1			
Printer	Cannon A-60	1	16.25	4.75	12.0
Headphone Jack Box	GRIM JV-603	1	5.0	2.0	4.0
IDCU Microprocessor	Intel 310-94	2	17.5	6.5	21.0
Color Monitor (IOT-1)	Mitsubishi C-6679AGK	2	15.75	14.12	16.62
Keyboard (IOT-1)	85-1A	2	18.0	1.5	6.5
IDCU Keytops (kit)	2003032 (STX drawing #)	2			
Serial Port Interface for Keyboard	ISM-232	2	2.12	0.87	4.5

NOTE: Quantities are for configuration having two IDCU workstations and one DF site.

TABLE 5-1. (cont.)

Remote Site

Equipment	Nomenclature	Quantity	Dimensions (inches) width	height	depth
Keyboard Power Supply	UPA-5/500	2	2.06	2.18	1.71
Trackball System	LX-200-192-EX	2	3.2	2.35	8.5
Bridging Adapter	Amphenol 2830109-01	1	6.75	5.5	1.5
Keyline interface		2			

Remote Site Cabling

Cabling	IDCU	RMMC	Inter-System
25 Conductor ribbon	2	24	-
50 Conductor ribbon	-	1	-
9 Conductor data	6	8	10 (25 pin)
9 Conductor ethernet	-	2	4 (9 pin)
Co-axial RGB	6	-	-
25 pair audio	1	-	4 (50 contacts)
4 pair audio/power	-	1	-
2 conductor identifier plug	2	2	-
3 conductor ac power plug	4	4	-
3 conductor dc power plug	-	1	-
2 conductor dc power	4	-	4 (molex-type)
2 conductor dc power	4	-	-
Keyboard spiral data cord	2	1	-
5 conductor phone (trackball)	2	-	-

NOTE: Connectors only supplied in kit form. Cable must be procured and built using connectors provided.

NOTE: Cables/Connectors supplied are for default configuration of two IDCU's and cabling for eight modems.

TABLE 5-2. CABLES REQUIRED BUT NOT SUPPLIED

Item	Function	Description	MIL Spec. Part Number	MFGR	Quantity	Remarks/cable Designation
1.	TELCO hookup; Tele. junction box to receiver/ processor	22 AWG, 8 conductor	CO-08 MLF (8/22) SJ0410		1 length as required	LW15
2.	Environmental Sensors; E-S Junction box to receiver/processor	22 AWG, 40 conductor	CO-40 MLF (40/22) SJ0860		1 as req'd	LW17, when env. sensors previously installed.
3.	Dc to Battery; Battery bank to receiver/processor	4 AWG, 2 conductor	CO-02 HLF (2/4) 1035		1 as req'd	LW22
4.	Battery Sense; Battery bank to receiver/processor	16 AWG, 2 conductor	CO-02 MLF (2/16) 0335		2 as req'd, for 4 conductor	LW23
5.	Ant. Control; receiver/processor to building entry box	20 AWG, 20 conductor (10 pairs)	CO-20 MLF (2/20Sx10) 0995		1 as req'd	LW14 tied to #6 lugs at GFE box
6.	Antenna Power; receiver/processor to building entry box	4 AWG, 2 conductor	CO-02 HLF (2/4) 1035		1 as req'd	LW28
7.	Preamplifier/Filter Power; receiver/ processor to preamplifier/filter	12 AWG, 6 conductor	CO-06 MLF (6/12) 0635		1 as req'd	LW21 Dc Power

TABLE 5-2. (cont.)

Item	Function	Description	MIL Spec. Part Number	MFGR	Quantity	Remarks/cable Designation
8.	Preamplifier/Filter Control; receiver/ processor to pre-amplifier/filter	22 AWG, 8 conductor	CO-08 MLF (8/22) SJ 0410		1 as req'd	LW20
9.	Ant RF; receiver/processor to preamplifier/ filter to building entry box	RG-214B/U Coax cable	M17/164-00001 NSN6145-00-660-8054		1 or 2 as req'd	LW18, LW33 (Only LW18 if preamp/filter not used)
10.	BITE RF; receiver/processor to building entry box	RG-214B/U	M17/164-00001 NSN6145-00-660-8054		1 as req'd	LW19, N plug to N plug
11.	Ant control; entry box to ant. electronics box	20 AWG, 20 conductor (10 pairs)	CO-20 MLF (2/20Sx10) 0995		1 as req'd	LW11, tied to # 6 lugs in GFE box
12.	Ant Power; entry box to ant. electronics box	2 conductor,				LW26, Terminal Lug
		4 AWG,	CO-02HLF(2/4)1035		1 1000-2000 ft	MS 25036-123
		8 AWG,	CO-02HLF(2/8)0805		1 500 to 1000	MS 25036-116
		10 AWG	CO-02HLF(2/10)0640		1 up to 500 ft	MS 25036-157
13.	Ant RF and BITE RF; entry box to ant. electronic box	RG-333/U Coax cable	MIL-C23806/1B		2 up to 2000 ft	LW12, LW13, N plug to N plug

TABLE 5-2. (cont.)

Item	Function	Description	MIL Spec. Part Number	MFGR	Quantity	Remarks/cable Designation
14.	Target Antenna; ant. electronics box to target antennas	RG-331 Coax cable	MIL-23806/2B NSN6145-00-174-3587		Up to 4 as required	LW7 through LW10, N plug to N plug
15.	Ac power to DF rack; building power panel to receiver/ processor and BCPS	12 AWG, 6 conductor	CO-06 MLF (6/12) 0635		2 as req'd	LW16, from two separate circuit breakers
16.	Ac power; Ac power to building power panel to obstruction lights	14 AWG, 3 conductor	CO-03 MLF (3/14) 0580		As required	LW27, from AC box
17.	IOT-2 to computer B	24 AWG, 9 conductor		9614 Belden	1 as req'd	RW2, DB-25 Male to Male
18.	Printer to RMMC	24 AWG, 9 conductor		9614 Belden	1 as req'd	RW3, DB-25 Male to Male
19.	IOT-2 to computer A	24 AWG, 9 conductor		9614 Belden	1 as req'd	RW1, DB-25 Male to Female
20.	Ethernet; RMMC-IDCU's	20 AWG, 9 conductor, 4 pairs plus ground	C-0007(TCL)	TCL,Inc.	2 as req'd	RW4, RW5, Locking Post & slide latch 206514, 745583-5

TABLE 5-2. (concl.)

Item	Function	Description	MIL Spec. Part Number	MFGR	Quantity	Remarks/cable Designation
21.	Dc power; terminal board to IDCU.	18 AWG, 2 conductor Lugs to Molex	NSN6145-00-097-9435	3241 Alpha	1 as req'd	RW17
22.	Audio/Control; RMMC-IDCU	24 AWG. 9 cond. DB-25, Male to Male		9614 Belden	1 as req'd	RW13
23.	Dc Power; IDCU to IDCU	18 AWG, 2 cond. Molex 4 to Molex 2	NSN6145-00-097-9435	3241 Alpha	As required	RW18 thru RW20
24.	Pilot Audio; RMMC-IDCU	24 AWG, 50 cond., (25 pairs)		5480/25 Alpha	1 as req'd	RW8, Amp Male - female
25.	Pilot Audio; IDCU-IDCU	24 AWG, 50 cond., (25 pairs)		5480/25 Alpha	1 as req'd	RW10, Amp Male - female
26.	Audio/Control; IDCU-IDCU	24 AWG, 9 Cond. DB-25, Male to Male		9614 Belden	1 as req'd	RW14
27.	Four-wire TELCO	24 AWG, solid 4 conductor shielded	CO-04 MLF (2/22Sx2)SJ	5902 Alpha	As required	RW21 thru RW44
28.	Rcvr/processor to BCPS and temperature sensor	16 AWG, 2 conductors	CO-02 MLF (2/16) 0335		2 as req'd	LW35 Battery Simulator
29.	DF Rack RMMC Modem	22 AWG, 8 conductors	CO-08 MLF (8/12)SJ0410		As required	LRW1 (used when receiver is collocated with AFSS)

TABLE 5-3 HARDWARE REQUIRED BUT NOT SUPPLIED

Item	Nomenclature	Quantity	Remarks
1.	1 1/2" - Hex Nut	12	Antenna Mast Mounting. (Fig. 3-5)
2.	Washer, Flat	6	For 1 1/2" bolt. (Fig. 3-5)
3.	1 1/2" dia. 14" long L-bolt	6	Set into concrete for the main antenna mast mounting. (Fig. 3-5)
4.	Carlon Carflex liquid-tight conduit; 1 1/2" diameter	quantity and length as reqd.	For RF, BITE Test, antenna control, AC power, DC power. (Fig. 3-5)
5.	Carlon Carflex liquid-tight conduit; 1" diameter	quantity and length as reqd.	For target antenna cables. (Fig. 3-5)
6.	Dow Corning DC4 or equivalent	as reqd.	Desiccant for pre-amplifier/filter cylinders 1 per-forated 1 nonper-forated. (Fig. 5-11)
7.	Copper Wire, Hard Line ground	as reqd.	# 6 gauge, length as reqd. to connect to facility ground bus. (Figs. 3-1, 3-3)
8.	Bolt/Nut, Brass or Stainless Steel, 3/8"	1	For preamplifier/ filter. (Fig. 5-10)
9.	Washers, Brass or stainless steel 3/8"	2	For preamplifier/ filter. (Fig. 5-10)
10.	Anchors, 3/8"	4	Appropriate for mounting surface of the preamplifier/filter. (Fig. 5-10)
11.	120" 3/4" diameter copper clad steel rod	1	Grounding rod for main antenna. (Fig. 3-5)
12.	Anchors 1/2", washers, and nuts	4 of each	Mounting hardware for the receiver/ processor group rack. (Fig. 5-9)

TABLE 5-3. (concl.)

Item	Nomenclature	Quantity	Remarks
13.	Anchors 1/2", washers, nuts	4 of each	Mounting hardware for the RMMC rack. (Fig. 5-13)
14.	Anchor 7/16", washer, and nuts	4 of each	Mounting hardware for IDCU. (Fig. 5-12)
15.	Carlon 1 1/2" straight fitting	5	For conduits listed in item 4. (Fig. 3-5)
16.	Carlon 1" straight fitting	4	For conduits listed in item 5. (Fig. 3-5)
17.	Carlon NEMA Junction Box with knockouts of 1.375" & 1.90"	0-4	Dependent on the number of target antenna. (Fig. 5-1)
18.	Carlon Terminal Adapter	0-4	Dependent on the number of target antennas. (Fig. 5-1)
19.	Flat washer with bushing part H E943HW	0-4	Dependent on the number of target antennas. (Fig. 5-1)
20.	Carlon Schedule 40 90° Elbow	0-4	Dependent on the number of target antennas. (Fig. 5-1)
21.	Carlon 1/2" Standard Coupling	0-4	Dependent on the number of target antennas. (Fig. 5-1)
22.	Rigid Schedule 40 Conduit	as reqd.	Dependent on the number of target antennas. (Fig. 5-1)
23.	6 Gauge Copper wire	0-4	Grounding strap for the target antennas. (Fig. 5-1)
24.	100 Watt Obstruction Light Bulbs	2	Connected to 120 VAC, 60 Hz, single-phase power source. (Fig. 3-3)

53. ANTENNA SITE PREPARATION. Subparagraphs 53a to 53s describe the preparation necessary for installation of the equipment at the antenna site.

a. Locate. A clear site with no obstructions or obstacles within 450 feet of the main array is the recommended siting criteria. Chapter 69 of this order provides information on collocating the antennas in an electromagnetic environment with strong signals. A survey of the area is necessary to determine the placement of the VDF main array and target antennas. Also, once the location of the main array is determined, points must be surveyed 150 feet from the main array in 5 ±.1 degree increments for a total of 72 points. Rugged, visible stakes are to be placed in the ground at each of these points. These are necessary to complete the site calibration which is discussed in chapter 6. Additionally, four points are to be surveyed for the target antennas as described in subparagraph 22b. The main array is to be installed not more than 2,000 feet in cable length from the receiver/bearing processor. Since this 2,000 feet is cable length, it must include tower height, building entry, etc. The target antennas are to be installed 150 feet from the main array as discussed in paragraph 22.

b. Locate and mount the building entry box on the wall of the building housing the equipment. The outside box should utilize bulkhead connectors with cable shields grounded to the building ground. All required cable crossings should be made in the outside box to account for positioning of cables in the inside entry box. The inside box shall contain appropriate terminal boards to transition cables and wires from inside the building to the outside. These terminal boards include two large gauge, three pin boards for ac and dc power to antenna, and two smaller gauge, fifteen pin boards for the antenna control cable. Conduit shall protect the cables as they leave the building.

c. Construct a steel reinforced concrete pad 5 feet x 5 feet at the location of the main antenna as shown in figure 3-5. The depth of the pad should be appropriate for the local frostline. Set six 14-inch long 1 1/2 inch diameter L bolts in the concrete equally spaced on a 16-inch diameter bolt circle as shown in figure 3-5. System software eliminates the need to align the antenna to true or magnetic north. If the antenna is to be mounted on a tower, the tower is to be constructed according to FAA-C-2621a, Design and Fabrication of Antenna Support Towers. A metal plate should be welded to the tower floor and drilled to the FA-10121 bolt pattern. Cutouts in this plate are necessary for the cables to the antenna electronics box and should be as close to the 24 inch diameter antenna mast mounting flange as possible. This installation shall include appropriate grounding and lightning protection in accordance with (IAW) FAA-STD-019 Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities and FAA Order 6950.19 Practices and Procedures for Lightning Protection, Grounding, Bonding, and Shielding Implementation.

d. Dig five trenches at least 3 feet deep from the base of the main antenna to each of the four target antennas (see paragraph 55) and to the location of the equipment building entry box. These trenches should join at the south side of the main antenna base.

NOTE: Depending on the relative bearing from the VDF antenna to the equipment building, it may be possible to dig the trench to the building close enough to a target antenna to run its cable in the same trench.

e. Construct a concrete pad for each of the four target antennas using the dimensions shown in figure 5-1; however, keep in mind that the depth of the foundation must penetrate the local frostline. Set the target antenna mast in the concrete with the hole at the base of the mast pointing towards the main antenna. Grounding rods should be included IAW STD-019 and FAA Order 6950.19.

f. Determine the length of cable required for the following cables which run from the building entry box to the antenna electronics enclosure (see figure 3-3). Add approximately 10 extra feet per cable. For tower mounted antennas, include a three to four foot service loop below the tower platform.

(1) Antenna RF, RG-333/U coaxial cable.

(2) Antenna RF, BITE Test, RG-333/U coaxial cable.

(3) Antenna Power, MIL Spec Cable # CO-20HLF (2/4) 1035 (see table 5-2). This cable is for a 1,000 to 2,000 foot cable run.

(4) Antenna Control, MIL Spec Cable # CO-20MLF (2/20s x10), 995.

(5) Obstruction light AC power, MIL Spec Cable # CO-03MLF (3/14) 0580; 14 AWG 3 conductor.

g. Determine the length of the four target antenna cables adding an extra 10 feet per cable (see figure 3-3). All target antennas use RG-331/U coaxial cable.

h. Cover the bottom of the trenches with a 6-inch level of sand if necessary.

i. Lay the cables from the building entry box to the antenna electronics enclosure in their trench.

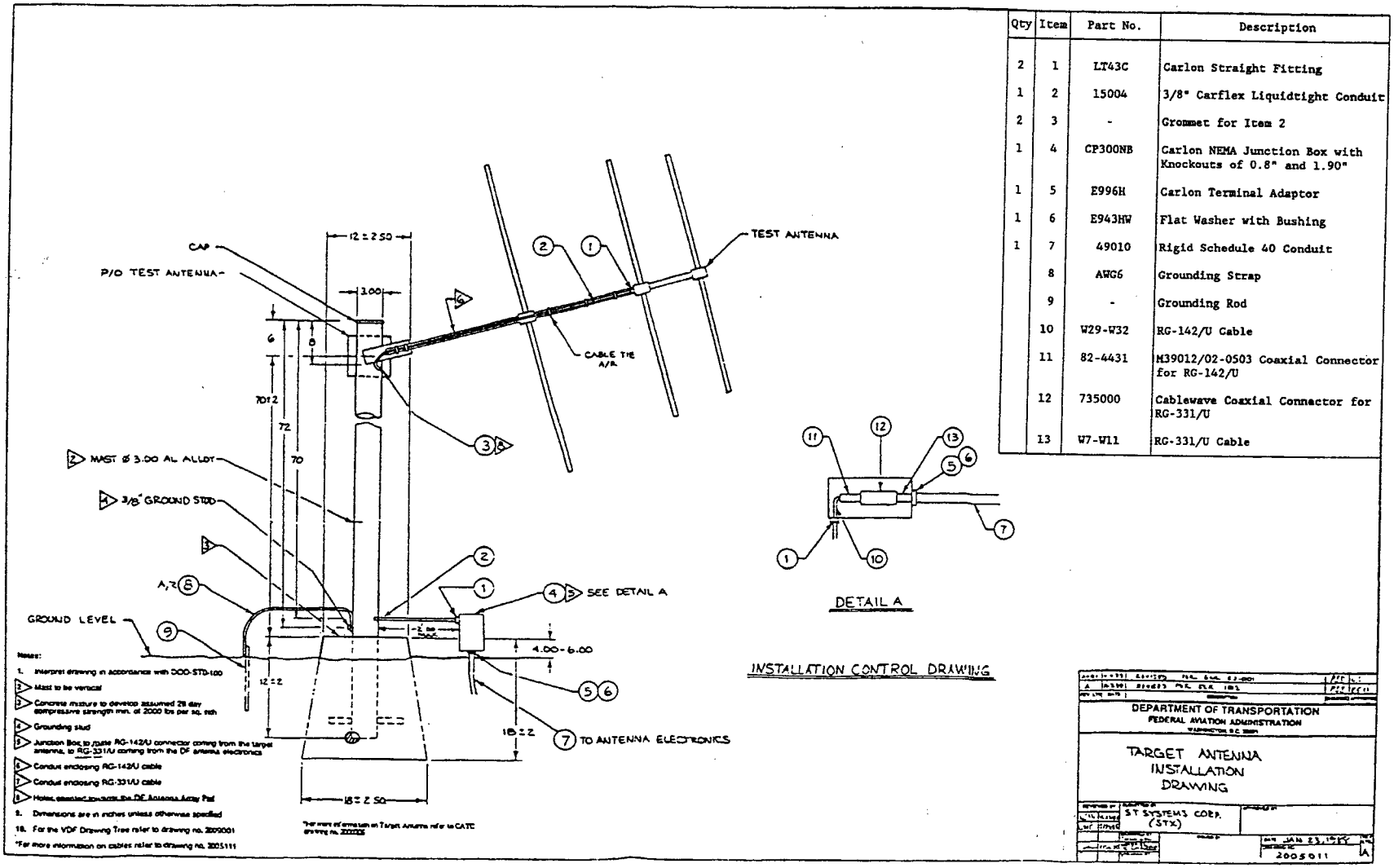
j. Determine the length of 1-1/2-inch conduit P/N 15010 needed for each cable (LW 11, 12, 13, 26, and 27) end. The conduit shall reach to the level of the sand in the trench.

k. Slide the conduit over their appropriate cable ends. Lay the cables in the appropriate trenches from the target antennas to the base of the main antenna.

l. Determine the length of 1-inch conduit (P/N 15008) needed for the main array end of the target antenna cables (LW 7, 8, 9, and 10) leaving enough length of conduit to reach the sand. Cut four straight 18-inch lengths of schedule 40 polyvinyl chloride (PVC) conduit (P/N 490010) for the target antenna ends of the cables.

m. Slide the conduit over their appropriate cable ends. Ensure that a minimum of 6 inches of the straight conduit will be above ground.

n. Arrange the cables to correspond with their entry positions into the antenna junction box (see figure 3-5, views B-B and C-C). Noting the junction



Qty	Item	Part No.	Description
2	1	LT43C	Carlon Straight Fitting
1	2	15004	3/8" Carflex Liquidtight Conduit
2	3	-	Grommet for Item 2
1	4	CP300NB	Carlon NEMA Junction Box with Knockouts of 0.8" and 1.90"
1	5	E996H	Carlon Terminal Adaptor
1	6	E943HW	Flat Washer with Bushing
1	7	49010	Rigid Schedule 40 Conduit
	8	AWG6	Grounding Strap
	9	-	Grounding Rod
	10	W29-W32	RG-142/U Cable
	11	82-4431	M39012/02-0503 Coaxial Connector for RG-142/U
	12	735000	Cablewave Coaxial Connector for RG-331/U
	13	W7-W11	RG-331/U Cable

FIGURE 5-1. TARGET ANTENNA INSTALLATION

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box entry will be just inside the bolt hole radius and about 18" above the concrete base, ensure that the minimum bend radii of the cables will be exceeded when connected to the antenna junction box.

o. Fill in the trenches with the dirt excavated in subparagraph 53d and restore it to its natural state.

p. Determine the location of VDF equipment in the building.

q. Determine the lengths of the cables from the building entry box to the filter/preamplifier (if used) and the receiver/processor group (see figure 3-3).

r. Determine the lengths of the interconnecting cables between the preamplifier/filter and the receiver processor group (see figure 3-3). Installation procedures for this equipment are contained in paragraphs 56 and 57.

s. Determine the length of the voice over data lines, route the lines using overhead conduit or cable trays to the telephone interconnection box, and make connections to the appropriate terminals (see figure 3-3).

54. ANTENNA ASSEMBLY. Subparagraphs 54a through 54nn discuss assembling the antenna.

NOTE: (WARNING)--Installation of the antenna requires the service of qualified riggers; normal FAA safety procedures for this type of installation must be exercised.

The following procedure assumes that a suitable foundation and interface for the base of the antenna mast has been prepared onsite IAW FAA standard installation drawings. An example of a typical antenna mast interface is shown in figure 3-5.

a. Remove the antenna mast from the packing crate. Verify that antenna mast base flange will mate with bolts in the mast mounting pad (see figure 3-5).

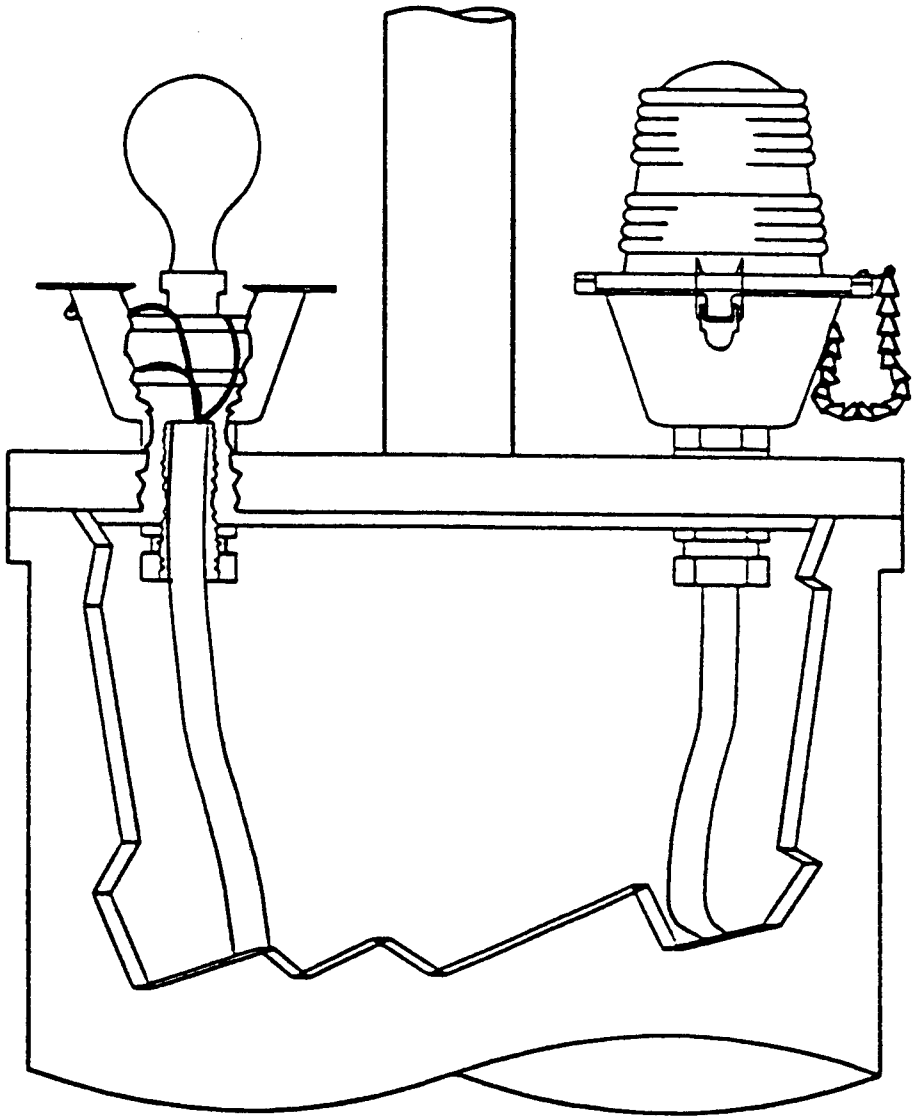
b. Hoist the mast into position on top of the mast mounting pad. Temporarily attach mast base flange to the mounting pad using six 1-inch ID nuts, flat washers, and lock washers (not supplied). Using a spirit level, determine that the mast is vertical. If mast is not vertical, use the alignment nuts on the mounting bolts under the mounting flange to align to vertical. Tighten mounting hardware to secure mast bottom flange to mounting pad (see figure 3-5).

NOTE: The open bottom end of the antenna mast should be closed up with insulating foam or other acceptible material to prevent penetration by nesting animals.

c. Remove the access plate and gasket from each side of the hub transition by removing sixteen bolts and washers. Put the plate, gasket, and hardware aside for later use.

d. Locate grease packet in RMMC rack drawer and apply grease to sense antenna and air terminal O-rings to form water tight seals. Attach the sense

FIGURE 5-2. COVER, GLOBE, AND LAMP ASSEMBLIES



antenna with its associated hardware and O-rings to the antenna hub assembly. Attach air terminal (lightning rod) to top of sense antenna.

e. Screw the two obstruction light bulbs (see figure 5-2) into their sockets and mount the obstruction light covers on the lamp bases.

f. Raise the antenna hub assembly and lower it slowly onto the mast, ensuring that the O-ring is not damaged, and that bolt holes are aligned.

g. Attach the antenna hub assembly to the mast using ten 1/2-inch nuts and lock washers supplied.

h. Screw the ten long sense antenna elements into the sense antenna tube lower collar and snug them down with a 5/16-inch wrench. Care must be taken not to overtighten these elements as the steel connector may strip the aluminum threads.

NOTE: Special care shall be taken handling the dipole arms. The nylon insulators that connect the two short dipoles into the longer support arm are easily broken by either shock or steady force and are not repairable in the field.

i. Pull loose the end of the doubled up cable out of the mounting flange of a dipole arm and hoist the dipole arm up the mast to the hub assembly.

j. Place an O-ring in the slot of the mounting flange of the dipole arm (see figure 5-3).

k. Hold dipole arm close to the 0 degree mounting plate of the hub assembly and drop the cable down the center hole of the mounting plate.

l. Place dipole arm mounting flange against the 0 degree mounting plate of the hub assembly (taking care not to pin the RF cable under the flange) and align with the dowel pins.

m. Screw the four bolts supplied into the hub assembly mounting plate and tighten them with a 7/16-inch wrench and attach safety chain.

n. Connect the 0 degree element cable to the proper hybrid input being careful to observe the markings of the hybrids on the hub electronics board.

o. Repeat steps (i) through (n) for each of the remaining nine dipole arms, working clockwise around the antenna, attaching them to the 36°, 72°, 108°, 144°, 180°, -144°, -108°, -72°, and -36° hybrid inputs (see figure 5-4).

p. Mount the antenna electronics enclosure (see figure 5-5) and antenna junction box to the brackets at the bottom of the mast, using bolts and lock washers supplied, and tighten the nuts down with a 7/16-inch wrench.

q. Loosen, but do not remove, the four slotted 7/16-inch screws around the antenna junction box door and lower the door.

r. Place nuts and lock washers on the mast access port studs and tighten them.

s. Route the six RF cables and two obstruction light ac power cables down through the mast into the junction box.

t. Replace access plates and gaskets on each side of the hub transition and replace the sixteen bolts and washers.

u. Connect the six RF cables to the appropriate bulkhead N-connectors at the top of the antenna J-box (see figure 3-2).

v. Remove the plastic knockouts H1 through H9, as needed, from the antenna junction box (see figure 3-5, view B-B). In cases where only three target antennas can be used, for example, all nine holes will not be needed.

w. Determine the proper place to cut the conduits to allow termination at the entry to the antenna junction box (see figure 3-5). Ensure that there is adequate slack in the conduit/cable to allow rework if necessary. Cut the conduits, being careful not to damage the cables.

x. Place the appropriate liquid-tight conduit fittings, either P/N LT43H or LT43F, over the cables and down onto the conduit and secure to conduit.

y. Arrange the cables exiting the ground in the approximate positions they will be entering the antenna junction box (see figure 3-5, views B-B and C-C).

z. Determine the proper length necessary between the conduit fitting and the corresponding cable connector assembly termination point in the junction box (see figure 3-2 for connector/cable part numbers) and cut cable to the required length.

NOTE: Allow adequate slack in the antenna control cable (LW11) to route individual conductors to appropriate terminal board positions once the cable's jacket has been stripped back.

aa. Install connectors onto coaxial cables in accordance with the instructions provided with each connector.

bb. Install and secure all conduit fittings to junction box with nuts provided with fittings.

cc. Connect all coaxial cables, LW7, 8, 9, 10, 12, and 13, to their respective connectors in the junction box as shown in figure 3-2. In certain cases it may be necessary to transition the large RF cables to RG-214 at the entrance to the junction box in order to make the connections inside the box.

dd. Dress and install lugs P/N MS25036-102 onto the antenna control cable LW11. If shielded pairs do not have associated drain wires to accommodate lugs, then a barrel splice (P/N 320559) and a short piece of wire with a lug may have to be used to terminate the shield of each pair.

FIGURE 5-3. DIPOLE ARM ATTACHMENT

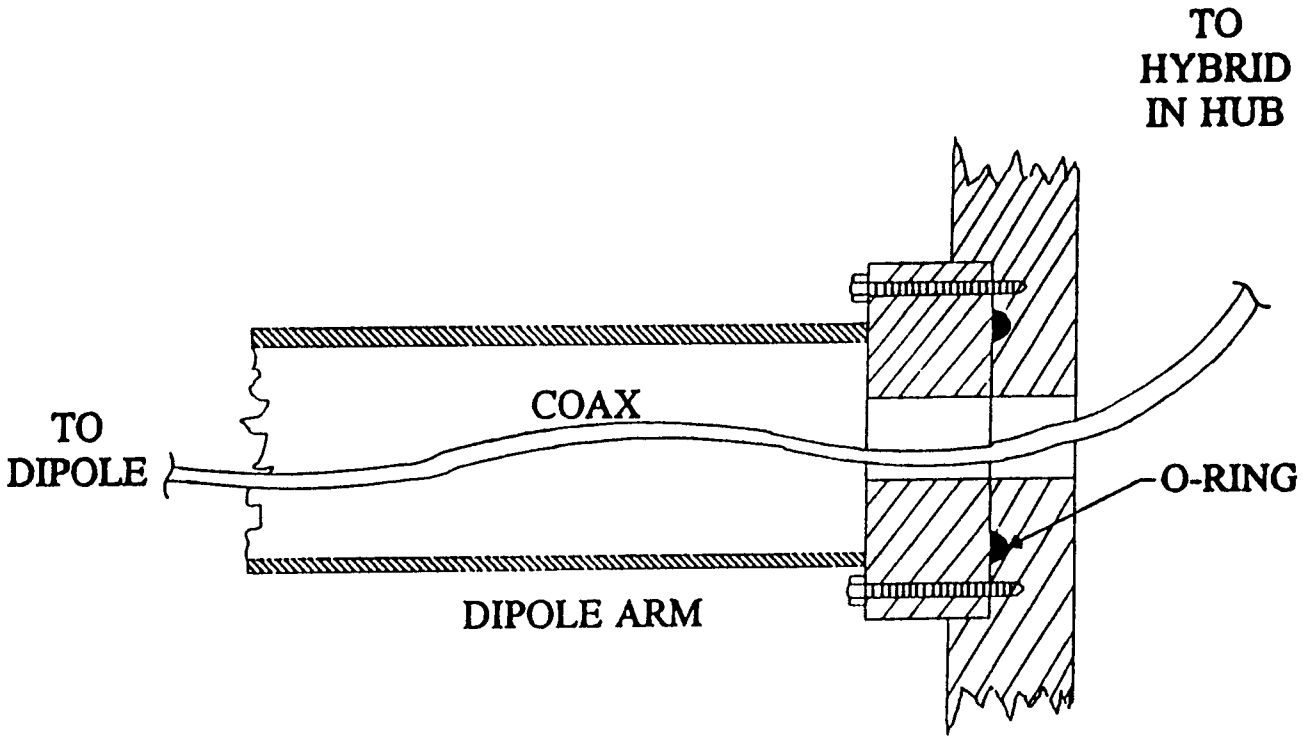


FIGURE 5-4. HUB ELECTRONICS DETAIL

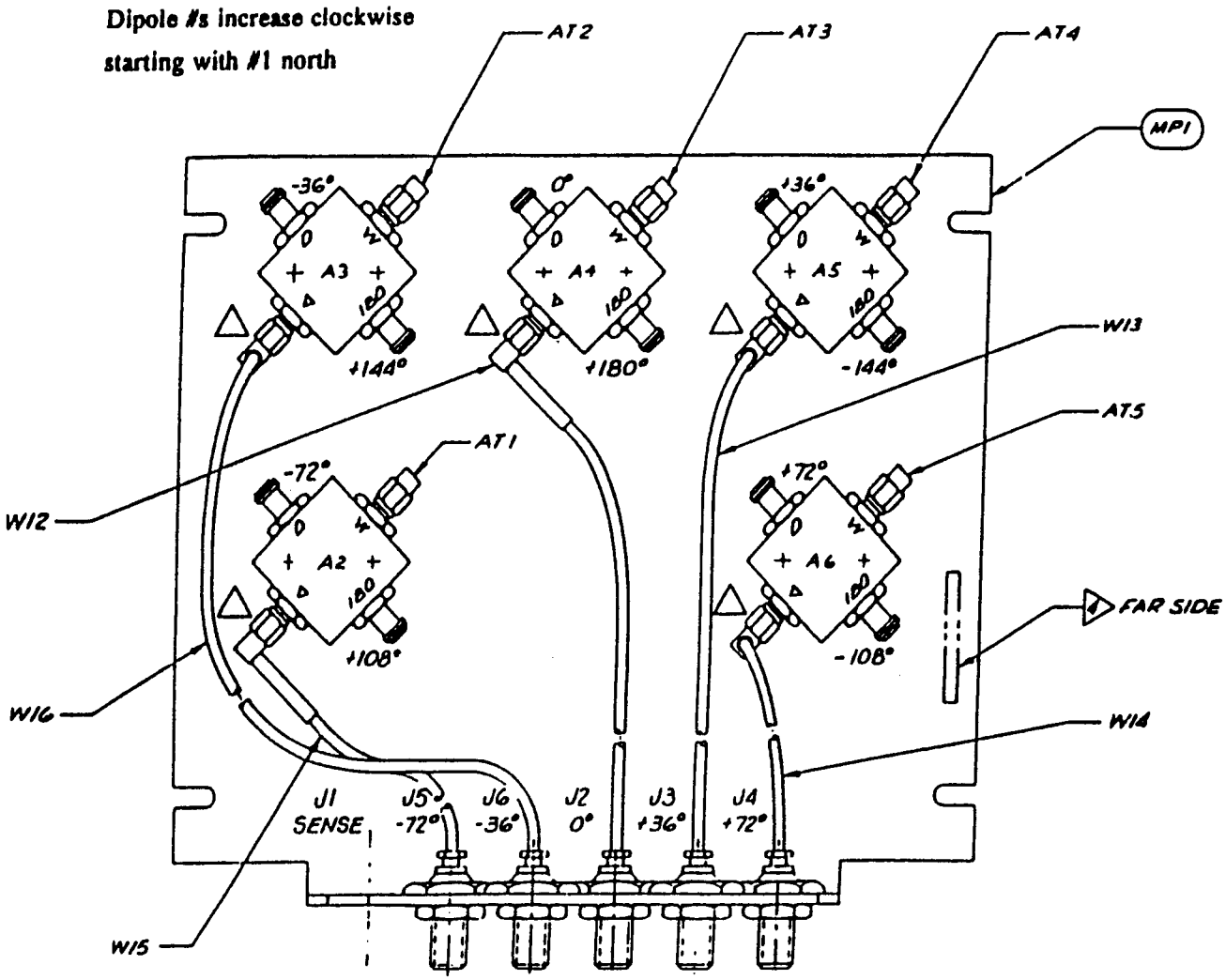


FIGURE 5-5. ANTENNA GROUP (UNIT 8-1 AND UNIT 8-2), OUTLINE DRAWING

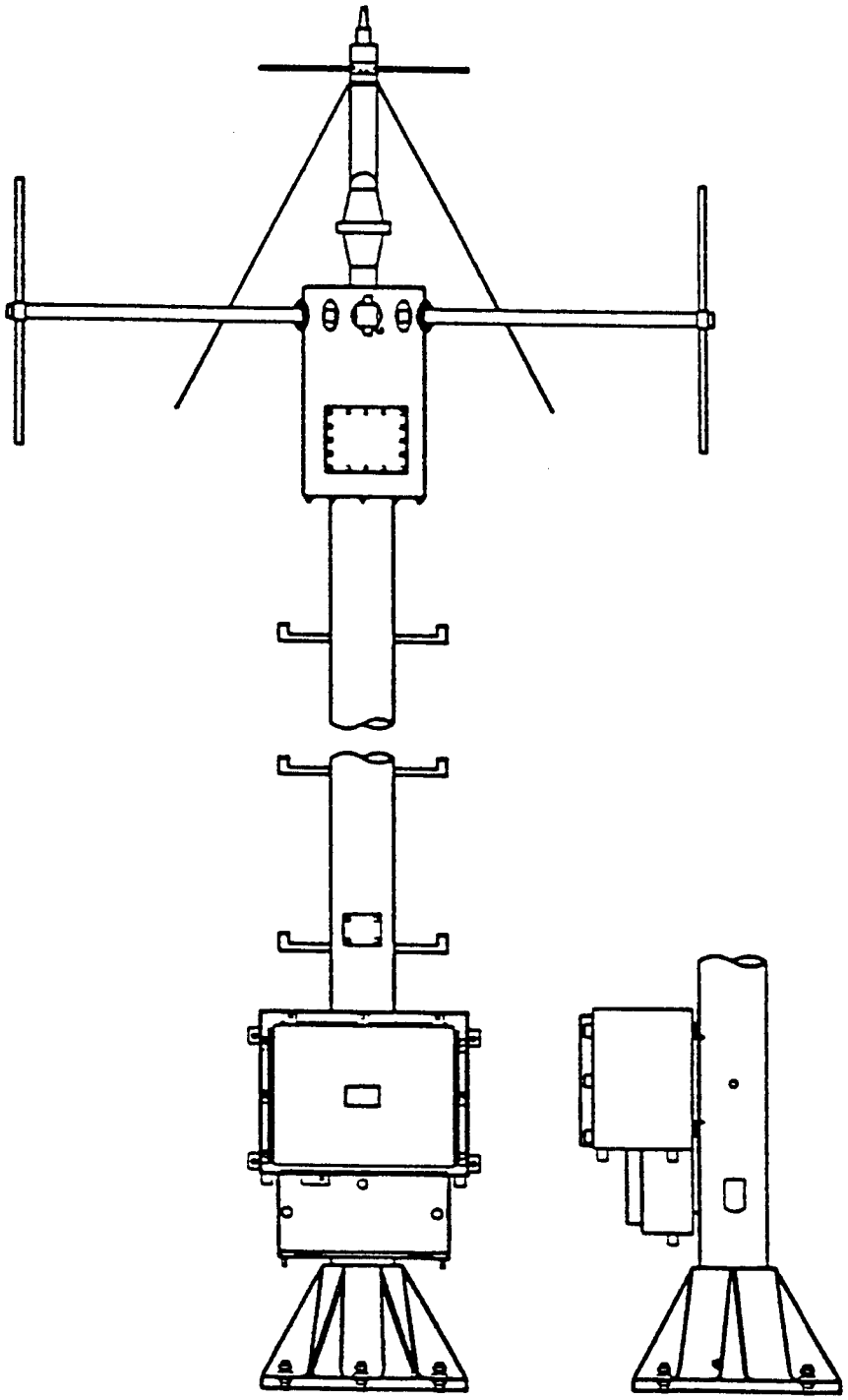
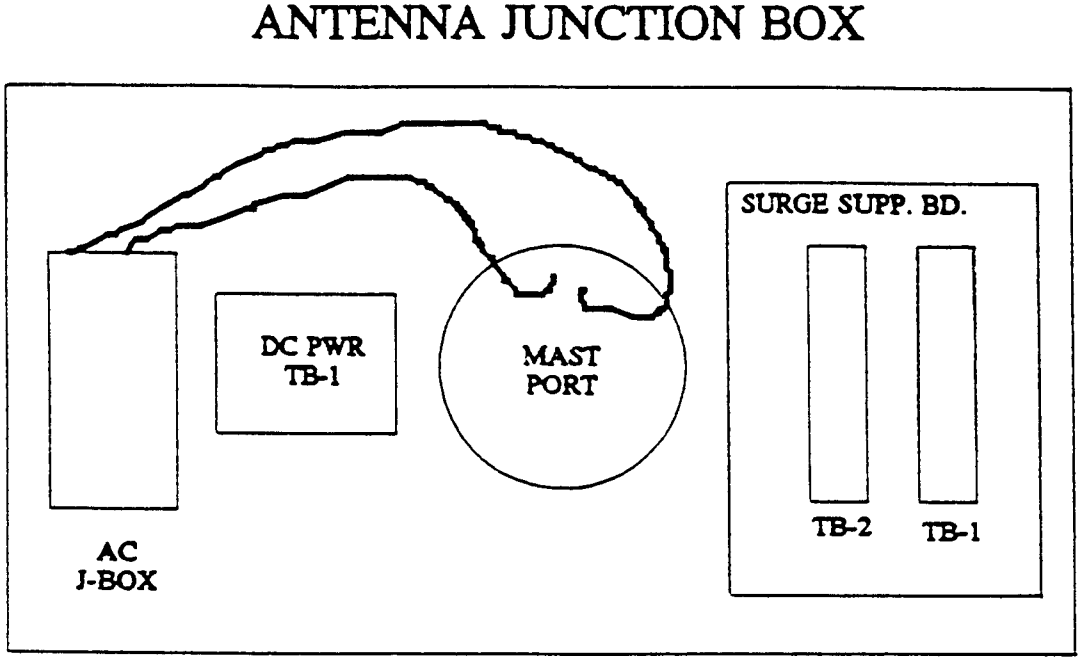


FIGURE 5-6. OBSTRUCTION LIGHT AC POWER CONNECTION



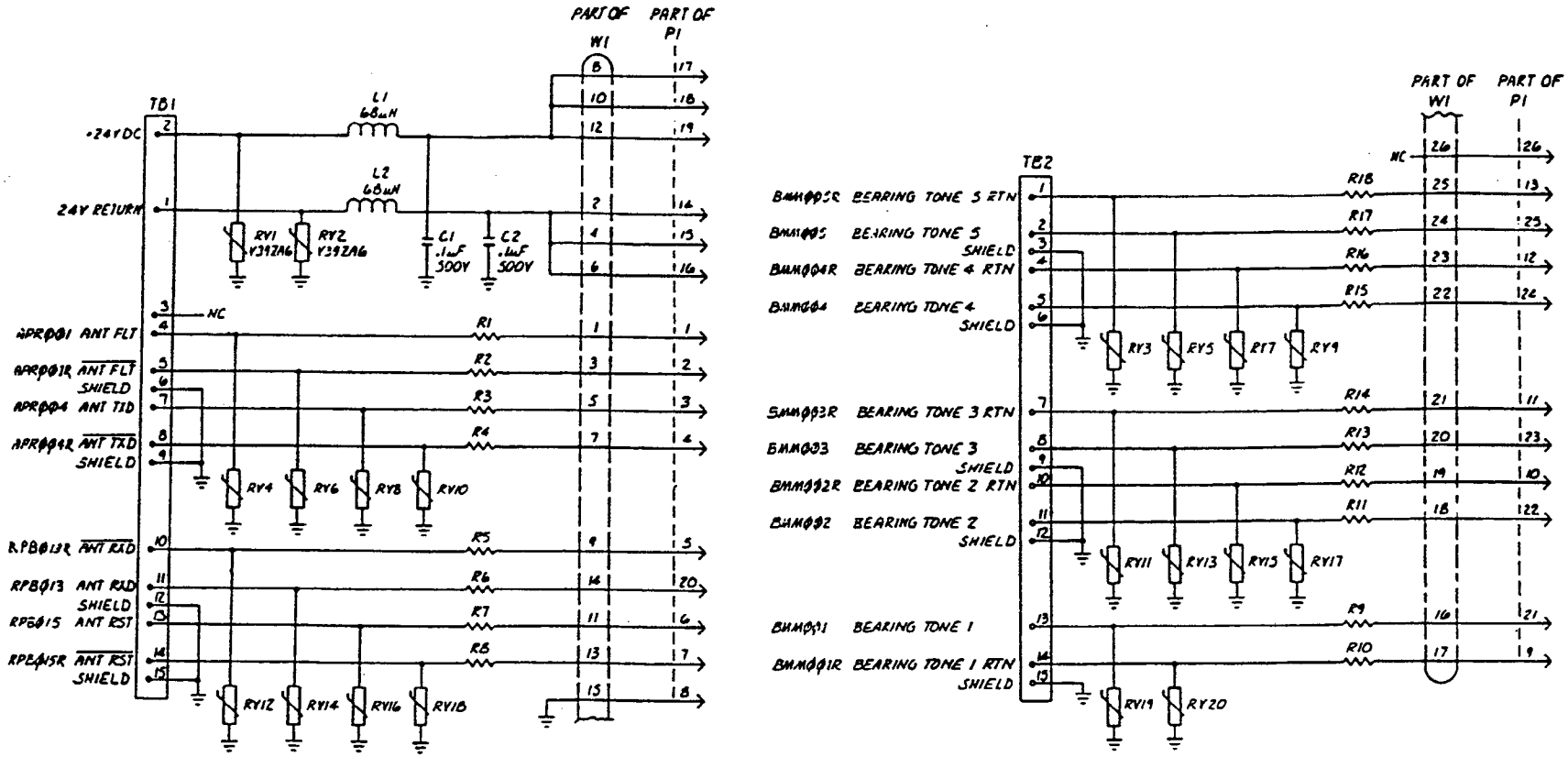


FIGURE 5-7. SURGE SUPPRESSOR SCHEMATIC DIAGRAM

ee. Connect cable LW11 to TB1 and TB2 of the surge suppressor board in the junction box in accordance with figures 3-3 and 5-7.

ff. Dress and install all lugs onto the dc power cable LW26. Connect LW26 to DC PWR TB-1 as shown in figures 3-3 and 5-7.

WARNING

Ensure that power to the GFE ac junction box is off before completing the following steps.

gg. Remove the front cover of the ac junction box on the left side wall of the antenna junction box exposing ac terminal board TB2 (see figure 5-6).

hh. Connect the incoming ac power cable to TB2 in the ac junction box as follows: white wire to pin 2, black wire to pin 3, and green wire to pin 1.

ii. Route the obstruction light ac power cable (LW27) from the mast to the ac junction box and connect as follows: white wire to pin 2, black wire to pin 3, and green wire to pin 1.

jj. Replace the ac junction box cover.

kk. Close the junction box door and secure the four screws attached to the cover.

ll. Attach grounding straps to ground rods and antenna according to FAA-STD-019 and FAA Order 6950.19.

mm. Refer to the receiver/control installation procedures (paragraph 56) to complete installation of antenna cables at the VDF site.

nn. Refer to the target antenna installation procedure (paragraph 55) to install the test antennas.

55. TARGET ANTENNA ASSEMBLY. The target antenna base and mast must be installed in predetermined surveyed locations 150 feet from the main array and the cabling must be available. However, in the event that the target antennas are to be inside the 150-foot radius due to land restrictions, locations of the antennas must be as close to the 150-foot radius as reasonably acceptable for the land available. With a ground-based main array the target antennas may be moved in to the main array as close as 75 feet FOR AN IDEAL ANTENNA SITE, however, it is strongly recommended that the target antennas be NO CLOSER THAN 100 FEET from the main array. The following procedures detail the assembly of the target antennas.

NOTE: The following procedures assume that a suitable foundation and interface for the base of the four test antennas has been prepared onsite in accordance with FAA standard installation drawings. Refer to figure 5-1. The antenna masts are to be installed 150 feet from the VDF antenna at four predetermined positions corresponding to ±20 degrees of the intercardinal points of 45, 135, 225, and 315 degrees. Refer to subparagraph 22b. The height of the mast must be sufficient to provide an unobstructed line of site from the target antenna to the VDF antenna within 30 degrees of horizontal.

a. Remove the test antennas and mounting hardware from the packing crate.

b. Refer to figure 5-1 and mount the test antennas (using materials provided as part of the local site installation kit and government furnished materials) as follows:

(1) Mount the flat swivel plate, with nomenclature side out, to the mast using u-bolts and hardware supplied. Position the plate such that the top of the plate is approximately 3 inches from the top of the mast. Fasten the plate to the mast loosely at this time to allow for later adjustment (see figure 5-8).

(2) Mount the test antenna to the plate using the hardware provided and adjust its position such that it is pointed toward the VDF antenna mast to the maximum extent possible.

(3) Adjust the vertical angle of the target antenna so that it is pointed at the top of the main VDF antenna array.

(4) Fasten securely the plate-to-mast u-bolts and the antenna-to-plate hardware at this time.

c. Use approximately 15 feet of liquid-tight flexible conduit (P/N 15004) and insert the conduit into the mast at the upper rubber grommet pushing it down through the mast and out the lower rubber grommet.

d. Use approximately 15-feet of coaxial cable (P/N M17160-RG142), install the male N-connector P/N M29012/01-0503 on one end of the coax using the appropriate crimp tool.

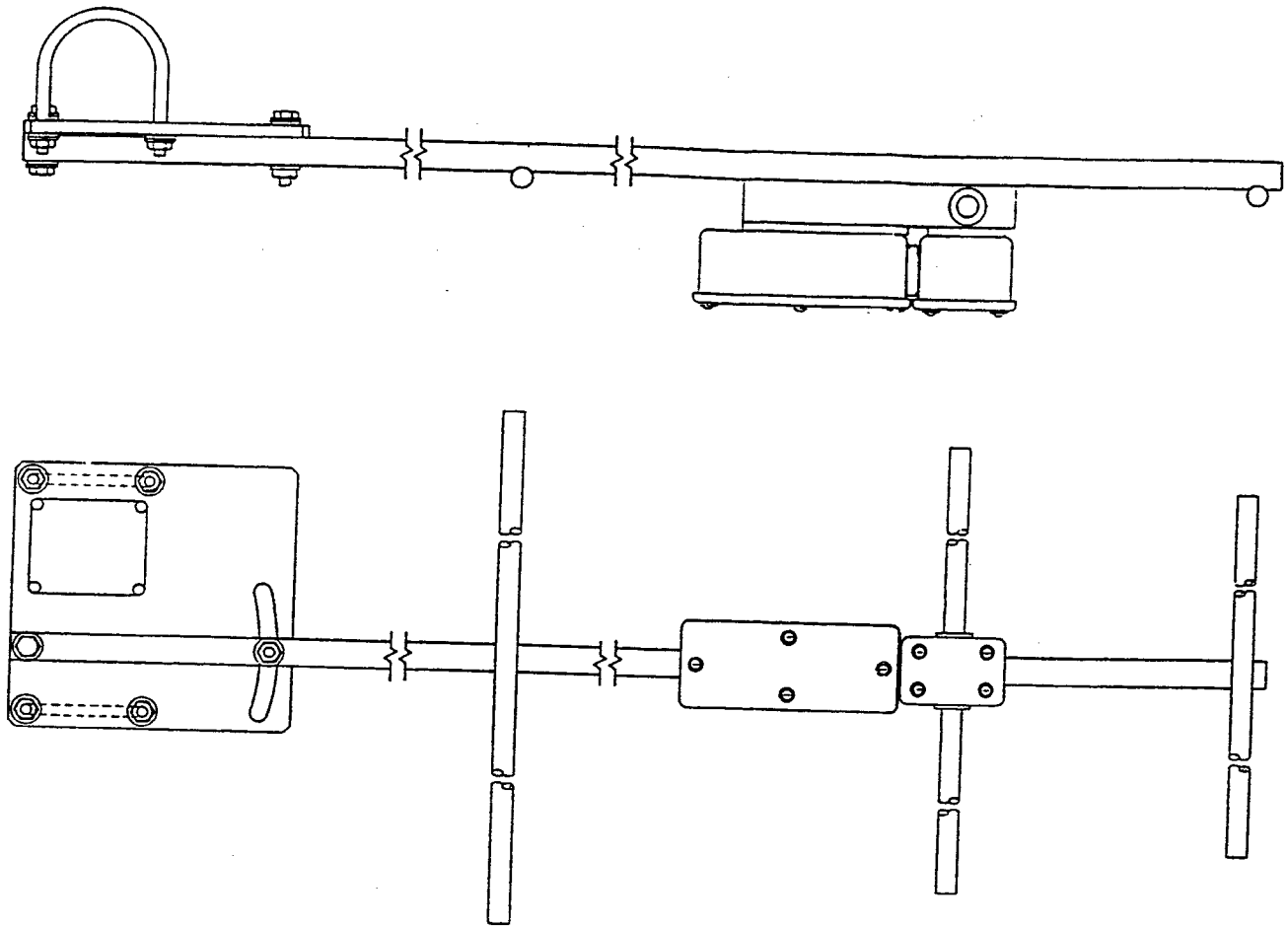


FIGURE 5-8. TARGET ANTENNA MOUNTING PLATE

e. Unscrew the cover from the junction box on the test antenna and install conduit fitting P/N LT430 in to the cable entry hole on the junction box.

f. Install the liquid-tight conduit into the conduit fitting on the antenna junction box.

g. Insert the coax cable (end without connector) into the conduit fitting in the antenna junction box and feed the cable through the conduit.

h. Connect the coax cable to connector in antenna junction box and replace cover.

i. Pull excess conduit out of mast from bottom and tie-wrap conduit to antenna to prevent wind damage.

j. Connect GFE grounding cable to 3/8-inch stud on bottom of mast. Attach grounding cable to grounding rod IAW FAA-STD-019 and FAA Order 6950.19.

k. Install conduit termination box fitting E996H onto conduit coming out of the ground from the main array.

l. Cut cable 4 inches above conduit termination and install the appropriate connector onto the cable using the instructions supplied with the connector.

m. Install junction box P/N CP300NB onto conduit termination using nut P/N E943HW.

n. Install conduit fitting P/N LT43C into opposite end of junction box and cut conduit coming from antenna mast base to fit into box fitting, leaving some slack for future rework.

o. Cut coax cable to allow for service loop inside junction box and install female "N" connector P/N M39012/02-0503 using the appropriate crimp tool.

p. Connect cable to cable in junction box and install cover.

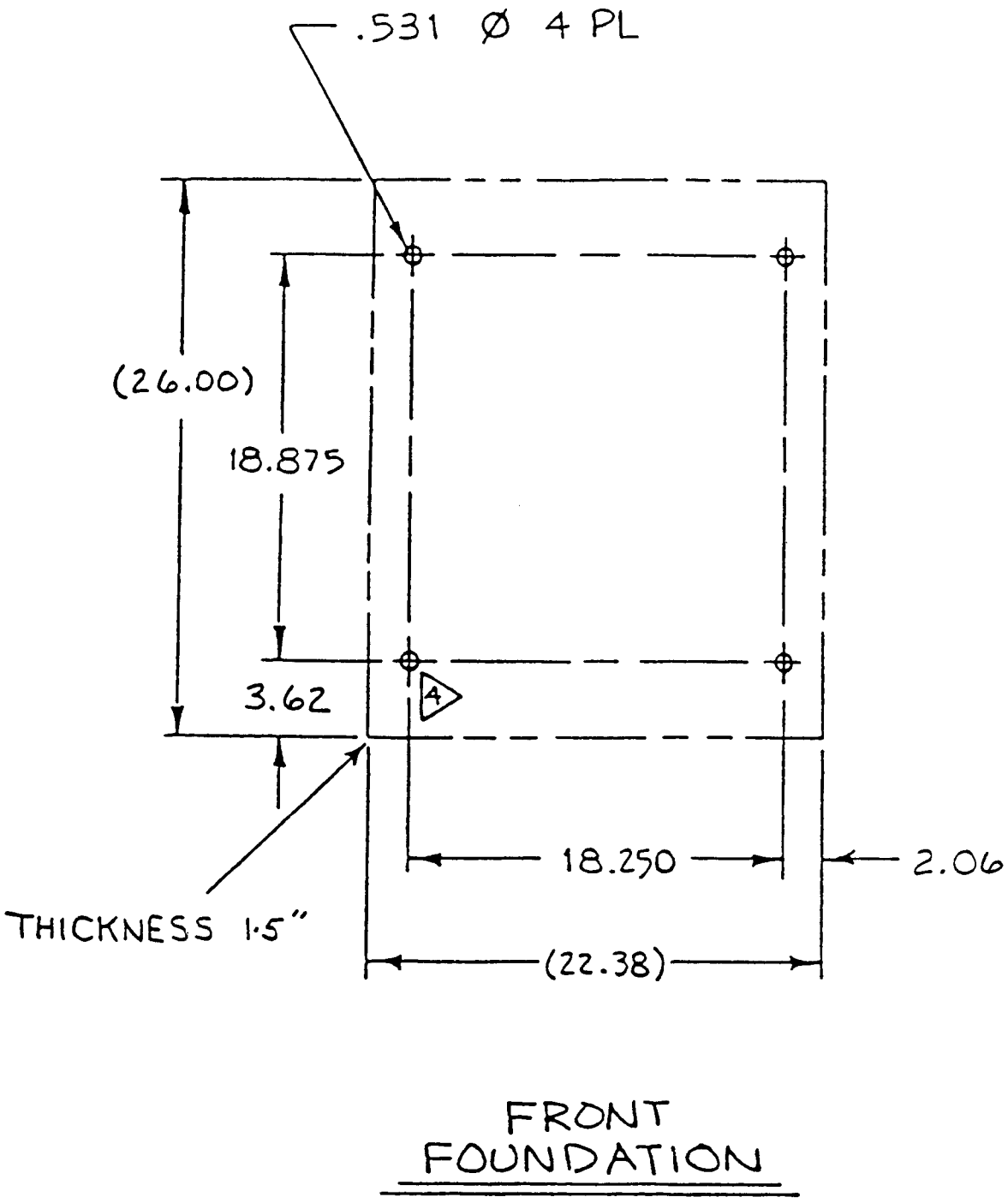
56. RECEIVER AND BEARING PROCESSOR UNIT ASSEMBLY. Installation procedures for the receiver and bearing processor unit are provided in the following subparagraphs.

a. Install the receiver/processor unit in a shelter at the antenna site not more than 2,000 feet in cable length from the main antenna array.

b. Use the footprint provided in figure 5-9 and the associated hardware and bolt the receiver/bearing processor rack to the floor of the shelter.

c. Ground the receiver/processor rack to the ground bus system of the facility IAW FAA-STD-020 Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment and FAA Order 6950.19. Typically, this system is bare #6 gauge copper wire. It is not necessary to install lightning and transient protection for the receiver site except for the incoming ac power. All signal and control lines have built in lightning and transient protection.

FIGURE 5-9. RECEIVER/PROCESSOR GROUP FOOTPRINT



d. Dedicate a 30 amp circuit breaker to the receiver/processor rack and label as such. Dedicate a 20 amp circuit breaker to the convenience outlet in the rack. Connect the circuit breakers to the facility's electrical system.

e. Connect all of the cables to their appropriate connectors at the rear of the unit according to figure 3-3.

NOTE: When the antenna site is collocated with the AFSS, cable LRW1 will replace cable LW15 at the local site (figure 3-3) AND cable RW21 at the remote (AFSS) site (figure 3-1).

f. Connect the GFE batteries if they are used. If the batteries are not used, LW22 and LW23 are not used. These are replaced by LW35 which is shown in figure 3-6. Temperature sensor LM135 is connected across U8J2 and U8J3 as shown in this figure.

g. Install the modem if it was not installed before shipment. Use the following procedure for installation. Remove the four-panel mounting screws from the modem-mounting panel and mount the modem in the panel using the four small screws. Connect the power cable, 581-1, to J4 on the modem; the telephone cable, 842-1, to J3; the audio cable, 829-1 (DC-37 connector), to J1; and the data cable, 829-1 (DB-25 connector), to J2. Replace the modem and modem-mounting panel.

57. PREAMPLIFIER/FILTER UNIT ASSEMBLY. The following paragraphs describe the installation of the preamplifier filter unit (if used).

a. Locate the preamplifier/filter in the shelter with the receiver and bearing processor unit not more than 2,000 feet in cable length from the DF antenna.

b. Mount the preamplifier/filter to the floor with 3/8-inch anchors at each corner of the units as shown in figure 5-10.

(1) If the enclosure is being mounted on a wood surface, use four wood anchor assemblies (3/8-inch shaft diameter), drill appropriately-sized holes and tighten securely.

(2) If the enclosure is being mounted on a concrete surface, use four concrete anchor assemblies (3/8-inch shaft diameter), drill appropriately sized holes and tighten securely.

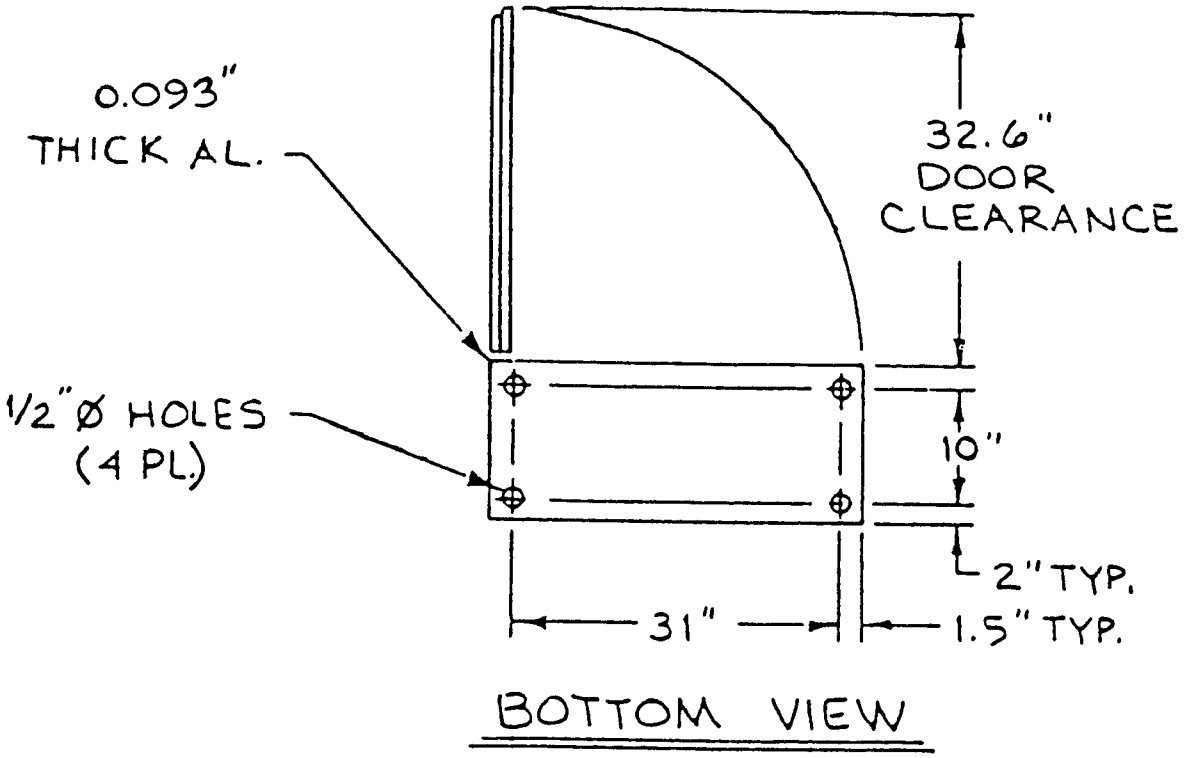
c. Attach the ground wire via the hole on the back surface of the bottom mounting area.

d. Push from the front, the 3/8-inch brass or steel bolt through the prepared grounding hole. From the back attach in the following order:

(1) three-eighths inch washer

(2) Ground lug

FIGURE 5-10. PREAMPLIFIER/FILTER FOOTPRINT



(3) three-eighths inch washer

(4) three-eighths inch nut.

e. Tighten securely.

f. Attach the free end of the ground wire to a suitable ground rod or grounding system IAW FAA-STD-020 and FAA Order 6950.19.

g. Use the special tool in the lower right-hand mounting area of the enclosure to loosen all door screws by turning 1/4 turn counterclockwise and open door.

h. Remove tools packed in the bottom of the enclosure, open the box, and check the contents against the contents list.

i. Use the 7/64-inch Allen wrench provided to remove the cavity ground wire from the back panel. Do not attempt to remove the wire from the cavity assembly.

j. Use the ribbon cable puller to disconnect from the interface board, three limit interconnects; P-6, P-7, and P-8; three encoder interconnects P-9, P-10, and P-11, and three motor interconnects, P-12, P-13, P-14.

k. Use the ribbon cable puller to disconnect from the processor the PROM interconnect cable A6W1.

l. Disconnect the Bayonet Neill - Concelman (BNC) fittings for the RF input (W9) and RF output (W8) coaxial cables from the right and left sides of the cavity, respectively.

m. Use the 3/16-inch Allen wrench provided to remove two screws from each of the two cavity top brackets. Lift out the brackets and set aside.

n. Grasp the cavity by the upper corners on each side and tip the cavity forward until the motors are cleared. Carefully lift the cavity out, ensuring that RF connectors clear enclosure frame. To avoid damage to delicate mechanisms when handling the cavity, avoid lifting by or bumping motor assemblies and/or RF connectors on sides. Lay the cavity in a horizontal position for later removal of shipping protectors.

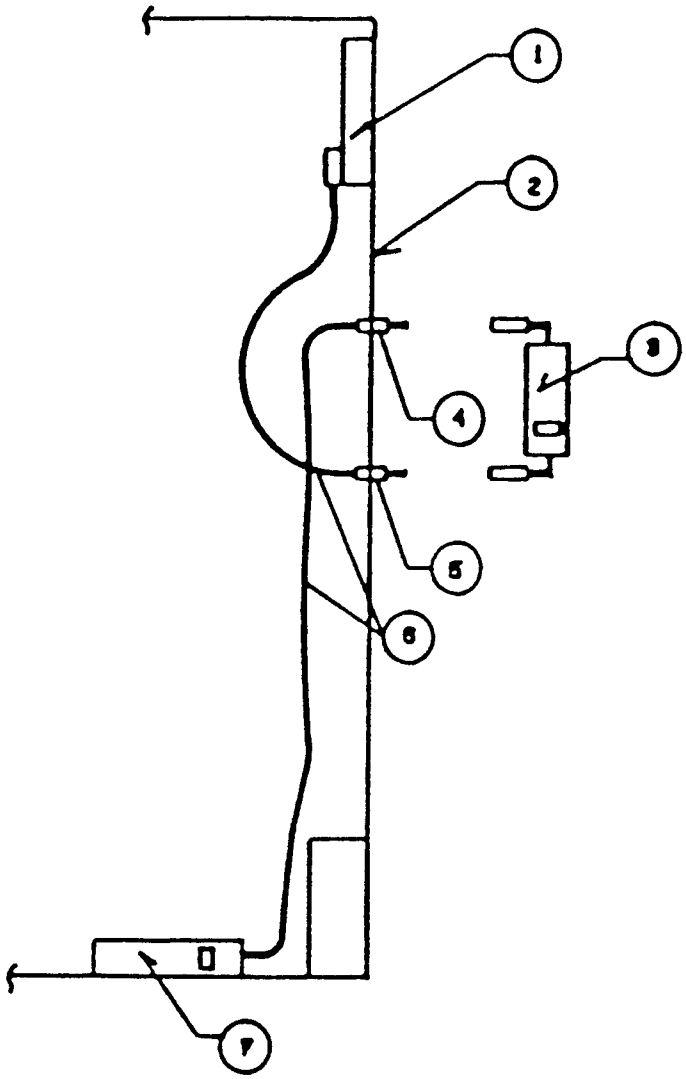
o. Remove the two boxes in the bottom of the enclosure.

p. Attach the longer length of tubing to the two-way check valve and proceed to paragraph 57w if the optional external desiccant cylinder is not used. If the external desiccant cylinder is used, subparagraphs 57q through 57v apply.

q. Detach the nuts inside the enclosure from the dehydrator system port plugs, located on the right side of the enclosure and remove the plugs as shown in figure 5-11.

r. Remove the two nuts from the bulkhead single end shutoff. From the outside, insert the threads into the dehydration system port. Reattach the inner

FIGURE 5-11. PREAMPLIFIER/FILTER DEHYDRATOR SYSTEM SCHEMATIC DIAGRAM



1	Two-way Check Valve	8A7A1
2	Enclosure Wall	8A8
3	Dehydrator Assembly, External	8A7A2
4	Bulkhead Fitting	8A7FT2
5	Bulkhead Fitting	8A7FT1
6	1/4" ID X 5/16" OD "Teflon" Tubing	8A7T1
7	Dehydrator Assembly, Internal	8A7A3

nut, and tighten securely. Reattach the outer nut and leave it loose. Insert the tube adapter (non-barbed end) into the outer nut and tighten the nut securely.

s. Repeat subparagraphs 57q and 57r to install the second bulkhead single end shutoff.

t. Attach one end of the shorter length of tubing to the lower bulkhead single end shutoff. Attach the free end of the tubing to the two-way check valve.

u. Attach the longer length of tubing to the upper bulkhead single end shutoff. Allow the other end to hang free into the bottom of the enclosure.

v. Set aside the wrapped desiccant cylinders. The cylinders must remain wrapped until immediately prior to installation. Installation of desiccant cylinders is performed immediately prior to securing the enclosure, subparagraphs 57ee and 57ff.

w. Reach into each section of the cavity from the bottom and extract the shipping protectors. Each protector is a two-part unit, and each part must be extracted separately.

x. Replace the cavity by orienting the cavity so that its front is facing forward. Lift and position the cavity in the bottom brackets, taking care with the motor assemblies and I/O connectors. When it is positioned correctly, and all cables are free, allow the cavity to gently settle into the brackets in an upright position.

y. Reverse the procedure for removal and reinstall the top brackets.

z. Reconnect the three limit interconnects; P-6, P-7, P-8; the three encoder interconnects, P-9, P-10. P-11; and the three motor interconnects, P-12, P-13, and P-14.

aa. Reconnect the PROM interconnect cable A6W1 to the processor board U16.

bb. Reconnect the RF input and RF output coaxial connectors to the sides of the cavity.

cc. Open the interface cable box and check the contents against its contents list.

dd. Connect the interface cables to their respective equipment as shown in figure 3-2.

ee. Remove the wrapper from the perforated desiccant cylinder. Push the free end of tubing over the end of the flanged connector. Lay the cylinder in the bottom of the enclosure.

ff. Remove the wrapper from the nonperforated cylinder. Holding the cylinder by both ends, push onto the outer connectors of the bulkhead single end

shutoff, until the connectors are securely joined.

gg. Close the door and using the tool provided, replace all screws in the door front. Replace the special tool in the bracket at the lower right mounting area. For turn on procedures see paragraph 72.

58. AFSS/FSS SITE PREPARATION. The following paragraphs describe the preparation necessary for installing the equipment at the remote site.

a. Determine the location of the RMMC rack and the IDCU consoles in the AFSS/FSS building.

b. Determine the length of the voice/data lines from the telephone demarcation box to the RMMC rack and connect the voice/data lines to their appropriate terminals (see figure 3-1).

c. Determine the length of the interconnecting cables between the IDCU's and the RMMC rack (see figure 3-1).

d. Refer to paragraphs 59 and 60 for installation procedures for the IDCU and RMMC racks.

59. IDCU ASSEMBLY INSTALLATION. The following paragraphs describe the installation of a single IDCU.

a. Install the IDCU consoles in the FSS/AFSS next to the in-flight service positions referring to the dimensions in figure 5-12. The consoles are provided without sides. If a console is to be mounted at the end of a row of consoles, the side of the AFSS console must be removed and installed on the exposed side of the IDCU.

b. Ground the IDCU frames to the ground bus system of the facility IAW FAA-STD-020 and FAA Order 6950.19. Typically, this system is bare #6 gauge copper wire.

c. Dedicate a 20 amp circuit breaker to the IDCU console and label as such. Connect the circuit breaker to the facility's electrical system. The IDCU console typically draws 2.5 to 3.0 amps from the 115 VAC line.

d. Connect all of the cables to their appropriate connectors at the rear of the unit according to figures 3-1 and 3-2.

60. REMOTE MAINTENANCE MONITORING AND CONTROL (RMMC) UNIT. Installation procedures for the RMMC are provided in subparagraphs 60a through 60e.

a. House the RMMC in the equipment room at the FSS/AFSS site.

b. Use the footprint provided in figure 5-13 with the associated hardware to bolt the RMMC rack to the floor of the FSS/AFSS.

FIGURE 5-12. IDCU FOOTPRINT

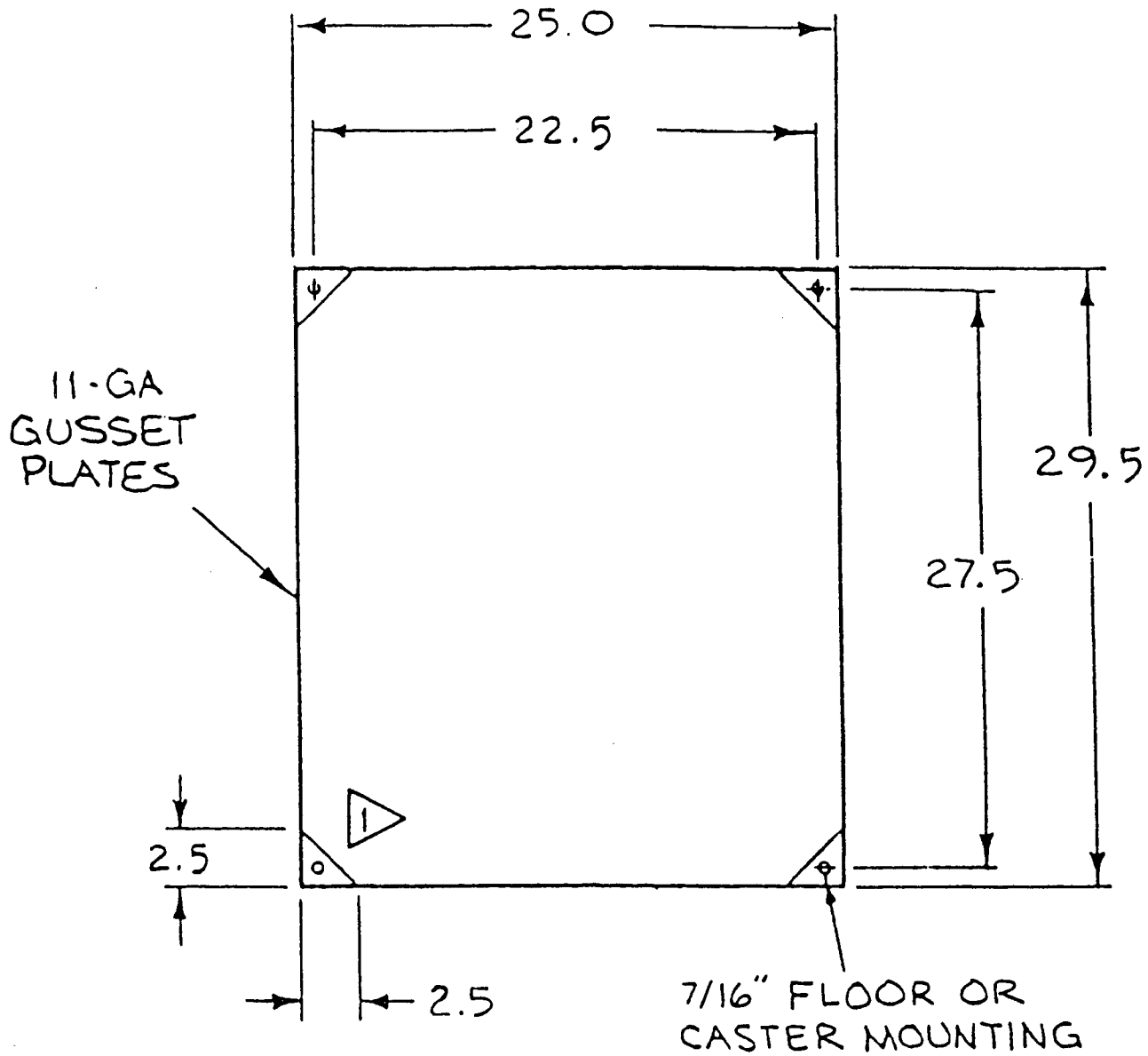
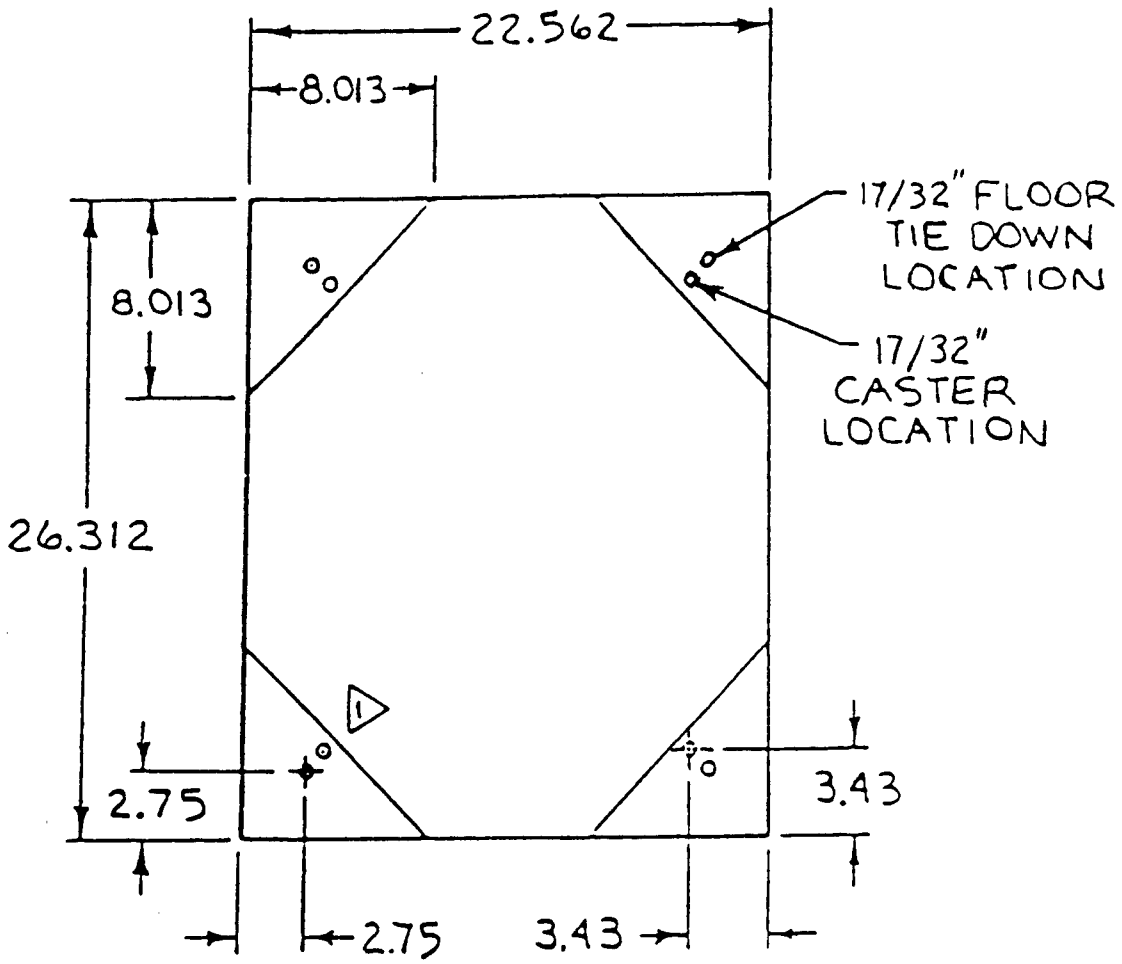


FIGURE 5-13. RMMC FOOTPRINT



c. Ground the RMMC rack to the ground bus system of the facility IAW FAA-STD-020 and FAA Order 6950.19. Typically, this system is bare #6 copper wire.

d. Dedicate a 20 amp circuit breaker to the RMMC rack and label as such. Connect the circuit breaker to the facility's electrical system.

e. Connect all of the cables to their appropriate connectors at the rear of the unit according to figures 3-1 and 3-2. IMPORTANT: See NOTE in subparagraph 56e.

61. FA-10121 VDF STANDARDS AND TOLERANCES. Table 5-4 contains the FA-10121 VDF standards and tolerances.

SECTION 2. WIRING AND CABLING

62. ELECTRICAL WIRING. Power wiring of the VDF/DF facility shall conform to specification FAA-C-1217e and to the National Electrical Code (NEC). All receptacles shall be three-wire grounding type, and all equipment conductors shall include an equipment grounding conductor, whether run in the same raceway as the branch circuit conductors or as part of a flexible cord.

a. Ducts and Conduits. All electrical wires from the circuit breaker panel to equipment cabinets shall be protected by approved ducts or conduits. At junction points of conduit-to-duct or conduit-to-electrical outlet boxes, bushings shall be installed to protect wires from physical damage. On cable tray systems, dividers shall be provided if power and radio signaling conductors share the cable tray. Outside electrical installations shall use moisture proof conduits and fittings.

b. Electrical Conductors.

(1) Single conductor wiring protected in ducts or conduits shall be thermoplastic covered wire, type THW or THWN. The wire size is determined by the current flow of the circuit. Most branch circuits are protected with 20 amp breakers which, in accordance with NEC, require use of No. 12 wire or larger diameter.

(2) Any wire splices shall be made with approved splicing connectors and be in accessible areas such as junction boxes and square ducts with covers.

c. Color of Wires.

(1) Ac Electrical Wires, either single conductor or three-wire cord types, shall be color coded as follows:

(a) White - neutral

(b) Green - ground

TABLE 5-4. FA-10121 VDF STANDARDS AND TOLERANCES

PARAMETER	(TI 6530.10) REFERENCE PARAGRAPH	STANDARD	TOLERANCE INITIAL	TOLERANCE OPERATIONAL
A. Frequency Range	6.2.2	118.0-136.975 MHz	.001%	.001%
B. Tuning	6.2.2	Automatically Adjustable to all 760 channels		
C. Sensitivity	6.2.4	-99 dBm (10 dB S + N/N)		
D. Selectivity	6.2.3	6 dB, ±10 kHz min 60 dB, ±25 kHz max	0.5dB	0.5dB
E. Undesired RF Response	6.2.3	-60 dB (outside 60 dB passband)		
F. Audio Speaker Output	6.2.4	-20 dBm to +20dBm (8 ohm load)	minimum range	
G. FCPU Audio Input	6.2.4	-16 dBm, to 0 dBm (600 Ohm load)	3 dB	3dB
H. Audio Frequency Response	6.2.4	less than ±1 dBm variation from 300-3000 Hz		
I. Squelch	6.2.4	Adjustable from -70 dBm to -95 dBm (50 Ohm load) Settable from -70 dBm to -110 dBm	3 dB	3dB
J. Muting	6.2.4	-40 dBm with no RF input and squelch threshold at 5mv		
K. Squelch Control	6.2.4	ON/OFF Provision at FCPU IOT		
L. BCPS Voltage	6.2.1	26.5 VDC	±2V	±2V
M. BCPS Voltage Ripple	6.2.1	≤600mv		

(c) Black - 115 volt ac (line A)

(d) Red - 115 volt ac (line B)

(e) Every other voltage will use separate color wire.

(2) Wires may be wrapped with colored tape at the exposed areas to conform to the color code in subparagraphs 62c(1)(a)-(e).

d. Receptacle Wiring. Most of the branch circuit wiring will terminate at equipment rack receptacles or to plug-in strips. The receptacles shall be three-wire type with proper identification of HOT, NEUTRAL, and GROUND terminals. Ac strips are usually wired in the field so that they can be made adaptable to the electrical needs of the rack. The VHF/DF convenience outlet requires a 20-amp circuit breaker.

63. SYSTEM WIRING.

a. Wiring and cabling between the ac power distribution panel in the facility building of shelter and the VHF/DF equipment or the antenna shall be installed to meet the present circuit demands.

b. Cable Installation. The existing 4x4-inch square duct in the facilities shall be used (if possible) for cable runs between the VHF/DF rack and the ac power distribution panel or the antenna access. Cables shall be installed in the duct in a systematic order with as few crossovers as possible. Where the number of cables requires stacking, the cables traveling the farthest shall be on the bottom of the rack. The first run of cables shall be secured to the tray at regular intervals using lacing cord or plastic tie-wraps (such as PAN-TY cable ties). Second, third, and succeeding stacks of cables are tied to those cables stacked below. If signal/control cable runs share a common duct with power cables, signal/control cables shall be isolated from power cables by a metal barrier or separate duct. At VHF/DF facilities, 3/4-inch thin wall conduit shall be installed for routing the power cable, and 1-1/2-inch thin wall conduit shall be installed for routing the antenna RF cables.

c. Dressing of Cables. Dressing of cables includes arranging them in a systematic order, removing the outer covering and inner insulation on individual pairs, and otherwise preparing them for termination to blocks or equipment connectors. It is very important that the cable dressing be carried out in a uniform manner throughout the installation and that the general appearance is pleasing to the eye. Cables extending into racks shall be arranged in the order of their use, with those terminating to the lowest part of the rack installed first and secured to the side wall of the rack. Other cables will lie on top and be tied to those cables stacked below. The cover of the cables and their inner insulation are to be removed at the point which allows ample room for splitting the wires before they enter the terminal block or connector. The foil around shielded pairs is removed at the cable opening point and the drain wires either removed or continued to the connector point.

d. Terminating Wires. Cable connections should be made only at terminal strips or in junction boxes. Cable lengths up to 1,000 feet should be continuous

in length (no splices). After dressing of the cables is completed to the intended terminating point, the individual cable pairs are separated. Actual terminating techniques depend on the type of connector or block being wired. However, on all installations some slack shall be left in the terminal wire. It is apparent that termination of the facility wiring is probably the most important operation of the installation and must be carried out professionally. The care and attention exercised on this phase will pay off when the equipment is placed in operation and when the facility is inspected periodically.

e. Insulation. When removing insulation from wires, insulation stripping devices that nick, mar, or damage the conductor in any way shall not be used. Good quality cable strippers should be used. The correct setting (size) of the stripping tool should be based on the size of the wire. Proper use of cable strippers will ensure that the wire is not nicked, a condition which could later cause breaks. Strip only the insulation necessary to make the connection.

f. Solderless Lugs. When using solderless lugs, the size and type of wire must be considered so the proper lug can be used. Lugs are color coded for wire size. Red lugs are for No. 22 through No. 16 size wire, blue lugs are for No. 16 through No. 14 size wire, and yellow lugs are for No. 12 through No. 10 size wire. Also, proper lugs must be selected for the right size screw. The lugs most frequently used are spade lugs that fit a No. 6 screw and are sized to accept either wire sizes of 14 through 16 or 16 through 22. All lugs used are insulated; therefore, no insulation needs to be installed. Special crimping tools are available for installation of lugs. Proper use of these tools is imperative for a good electrical connection. All stranded wire requires the use of the lugs. Stranded wire shall not be installed under a binding post without the use of a lug.

g. Plastic Tubing. When soldering wires to cable plugs, lengths of spaghetti (plastic tubing) shall be used over each wire and connection point. This will ensure to the maximum that shorts are prevented. A cable clamp is to be used on all plugs to avoid strain on the cable connections and to avoid twisting.

h. Equipment-to-Equipment Connections. In a number of cases, direct equipment-to-equipment connections have to be made. They are generally of two types. In one type, a fixed length of cable with suitable connectors at either end are factory made and supplied complete with grounding connections. It is desirable to use them as supplied unless the length is insufficient. In the other type, only the equipment connectors are provided and the cable must be fabricated at the site using the required length of the appropriate type of cable. Care shall be taken to use only the specified type of cable with proper shielding and ground drain connections where necessary. These cables need not be routed through cable ducts and trays unless they span over racks or consoles.

i. Handling of Shields. Cable having shielded pairs shall have their shield grounded at the equipment end only. Shielded pairs normally have an aluminum foil wrapping with a bare wire (drain wire) under the foil. In such cases, only the drain wire is terminated to the ground. The best installation is achieved by removing the foil from all cable pairs at the same point, twisting their drain wires together, and attaching them to the insulated shield ground bus keeping leads to ground as short as possible.

j. Marking Cables. All cables shall be tagged at each end for easy identification. Positioning of markers or labels should permit easy identification. Positioning of markers or labels should permit easy access without disturbing adjacent wiring and cabling. The markers used for this purpose should be of a type that is both durable and easy to install (such as PAN-TY markers). In all cases, markers should be installed in accordance with the manufacturer's recommendations.

k. Clamping Cables. Cables shall be supported adjacent to connectors by a cable clamp of appropriate size to prevent pulling on the connector. The distance between the cable clamp and connector should be such that the connector can be easily removed and reattached to its mating unit while minimizing loading on the connector.

l. Wiring Checkout. Every connection made during an installation shall be verified both for unintended grounding and circuit continuity before energizing the system. Unintended grounding shall be tested with low voltage meter or a multimeter set to a high resistance scale.

m. Resistance. The resistance between the ground and the wire shall be nominally infinite. Continuity testing shall be accomplished by setting the multimeter on a low resistance scale. One end of the wire is connected to a common wire (ground wire). The resistance between the other end of the test wire and common wire is measured. Continuity is established when this resistance is nominally zero. When testing equipment plugs, wiring tests shall be performed for possible shorts between adjacent terminals.

64. INSIDE CABLE DUCTS.

a. General.

(1) A wide variety of methods for distributing interconnect cables and wiring are presently in use throughout the FAA. These methods include the following:

(a) Cabinet top open-type racks.

(b) Cabinet top enclosed ducts/trays (commercial and fabricated).

(c) Raised computer floor.

(2) In VHF/DF installations, the cable distribution method for the facilities shall be via the existing 4 x 4-inch square duct or via newly installed conduit.

b. VHF/DF 4 x 4-Inch Cable Ducts. The following guidelines shall be used in modifying or installing sections of the 4 x 4-inch ducts.

(1) Ducts procured from commercial sources should not have "knockouts."

(2) Ducts procured from commercial sources should be assembled and installed using matching hardware.

(3) Fabricated ducts should be assembled and installed using properly selected hardware.

(4) Where cutting is required the workmanship should be such that all edges will be smooth, fit well, and be aligned.

(5) Surfaces of duct work should be level, plumb, and square.

(6) Duct work will be grounded throughout their length using bare copper No. 6 AWG wire. The ground wire shall be attached to each section of duct work (exclusive of couplings) and mechanically fastened to clean metal with copper or bronze Blackburn LB-70 or equal type connectors. The ground wire should be continuous to its termination at the building ground, but need not necessarily be a single piece.

(7) Ducts may be insulated from equipment racks, consoles, etc., with phenolic spacers and nylon attaching screws. This practice is recommended for prevention of ground loops which could result in additional circuit noise.

SECTION 3. GROUNDING, BONDING, AND SHIELDING

65. GROUNDING.

a. General. Electronic circuits should be grounded to minimize interference levels and hazards to personnel. Ensure that grounding of the system does not interfere with the existing grounding systems and/or new or existing equipment in the facility.

b. Requirements of a Satisfactory Grounding System. A satisfactory grounding electrode system must always be available at the facility in which the equipment is to be installed. The grounding conductors to the equipment being installed must provide a low-resistance path to the grounding electrode system for the electronic grounding system and a low-impedance path to the earth electrode system for the equipment grounding (ac power) conductor. Install the electronic grounding system as defined hereinafter and in accordance with the applicable guidance provided in FAA-STD-019b, Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities, for the grounding system of the electronics equipment in the facility, FAA-STD-020b, Transient Protection, Grounding, Bonding and Shielding Requirements for Equipment, and FAA Order 6950.19 Practices and Procedures for Lightning Protection, Grounding, Bonding, and Shielding Implementation for the grounding system(s) utilized in the equipment. Both standards give applicable guidance for the termination of the grounding conductors, shields of conductors, etc., at either end of the grounding conductor installation. Install the equipment grounding conductor in accordance with the applicable guidance provided in FAA-STD-019b and FAA-STD-020b and the applicable requirements of Article 250, Grounding of the National Electrical Code (NEC). A grounding system as defined in FAA-STD-019b and FAA-STD-020b shall also be installed where required for the grounding of lightning surge and transient protection.

c. Electronic Grounding Systems. Electronic grounding systems shall be compatible with new and existing equipment. Single-point (signal reference) grounding systems shall be isolated from all other grounding systems except at the tie to the earth electrode system. Multipoint systems shall be bonded to structural members of the equipment housings, structural members of the facility, conduits, cable trays, etc., to provide as many ground paths in parallel as feasible to the earth electrode system. DO NOT substitute any of the electronic grounding systems for the equipment grounding conductor of the ac power system.

d. Single-point (Signal Reference) Grounding.

(1) This system requires an insulated bus in the equipment as the common ground which will be the low-resistance reference point or plane in the piece of equipment. Design practices and techniques must be such that the signal reference point of the equipment can be properly interfaced with other equipment, new or existing without compromising the grounding system. The insulated reference plane must be copper bus or plate suitable for utilization for termination of cable shields and for connecting the signal ground of the equipment to the signal reference network of the facility.

(2) The shields of the data, signal, and control cables will be terminated on the isolated signal reference bus keeping the pigtails of the shields as short as possible. The insulated bus will be connected to the earth electrode system with a copper conductor insulated with a green jacket having a yellow tracer (stripe). This conductor shall be isolated from other grounding systems throughout its entire run to the earth electrode system connection. Where protection of this conductor is necessary pvc conduit shall be used. Where the connection of the signal reference ground conductor to the earth electrode system is made, at the grounding electrode conductor, the ac main service disconnection means a suitable connector must be used. This connector must be a type that will not change the characteristics of the grounding electrode conductor in that it is no longer a continuous conductor without a splice in its run to the earth electrode system.

e. Multipointing Ground System. Connect multipointing ground system to the equipment frames, cabinets, racks, etc., to the conduits, wireways, cable trays structural steel members, etc., and to the conductors used to make all the interconnections. The multipoint grounding system shall provide multiple low resistance paths between the various parts of the facility, between the items of equipment within the facility, and between any points within the system and the earth electrode system in order to minimize the effects of noise currents that may be present in the grounding system. The multipoint system grounding conductors shall be copper with green insulation and an orange tracer.

f. Installation of Electronic Grounding Systems Conductors. Guidance for the installation of the grounding conductors for the electronic systems, including but not limited to, size, method of termination, installation, etc., is given in paragraphs 3.11 and 3.12 of FAA-STD-019b.

g. Equipment Grounding Conductor. The equipment grounding conductor must be copper with green insulation and shall be installed in the same raceway as the branch circuit conductors feeding the equipment. If a power cord is used, the green conductor must be integral with the phase conductors of the cord. The conductor shall be terminated on the equipment case utilizing approved fittings. Where a power cord terminates on a grounding type attachment plug, the equipment grounding conductor of the cord shall terminate on a fixed ground contact of the plug. For equipment supplied through a connector, the connector shall contain a grounding pin terminating the equipment grounding conductor, which is integral with the other conductors, to the connector. Do not rely on nor substitute conduits or cable shields, although electrically continuous and firmly bonded to the equipment cases, as the equipment grounding conductor. The equipment grounding conductor shall be sized in accordance with Table 250-95 of the NEC.

h. Surge and Transient Protection Grounding. All equipment signal landlines and the ac power feeders entering or leaving the facility shall be protected against lightning induced surges entering the facility on these lines. The grounding system is a vital part of this protection and shall be installed to meet requirements set forth in FAA-STD-019 Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities and the following:

NOTE: Lightning and surge protection is already built into the antenna site equipment with the exception of the incoming ac power lines.

(1) Landlines protected by surge devices, which shunt the over-current flow to the earth grounding system while clamping the voltage and energy to a level below the equipment susceptibility level, shall be grounded in such a manner that the low energy (triggering) devices are solidly bonded to the grounding conductor of the equipment, and the high energy devices are connected to the earth electrode system in as short a direct path as feasible. Bends shall be kept to a minimum, and sharp kinks are not permitted. The conductor shall be No. 6 AWG copper. The ground connections to the high energy devices shall be isolated from all equipment cases, cabinets, other ground systems, etc., until the connection is made to the earth electrode system, either at the system itself or to a copper conductor connected to the earth electrode system. If the connection is made at the latter point, this shall be at a point where the conductor to the earth electrode system exit the building.

(2) Cables with shield or armor over the conductors shall have the shield or armor fairly connected at the building interface to the nearest suitable grounding system. This excludes any single-point (single reference) grounding system. A connection readily available to the earth grounding system is preferred.

(3) Coaxial cables entering the facility may be terminated on a metal bulkhead plate compatible with the cable connectors where the cables first enter the facility. The bulkhead plates, coax connectors to the plates, and grounding of the plates shall be in accordance with paragraph 3.8.7.2 of FAA-STD-019b.

i. Grounding Conductors. Ground wires, straps, bonds, and jumpers shall be without splices or joints.

66. BONDING.

a. General. High quality bonding between conducting elements throughout the facility is essential to the effective functioning of all grounding and shielding applications within the facility.

b. Requirements. All bonding installations shall be accomplished in such a manner that proper joints, connections, and interfaces will be suitable and proper for the system. Bonds shall be installed as defined hereinafter and in accordance with the applicable parts of Paragraph 3.14, Bonding Requirements of FAA-STD-019b. Connections to equipment shall follow the guidance of this chapter and FAA-STD-020b. Bonding of the ac power systems shall be in accordance with the applicable requirements of the NEC.

c. Methods. Bonding may be by welding or UL approved connectors. The connectors shall be of the bolt or clamp type. Where bolt types are used, the surface contact area to flat surfaces shall be three square inches (545 sq. mm) or greater. Soft soldering or brazing shall not be used for any part of the lightning or surge protection system or in the ac power or multipoint ground systems. Soft solder shall only be used to improve conductivity at load bearing joints and shall not be used to provide mechanical restraint.

(1) Welding shall be in accordance with paragraph 3.14 of FAA-STD-019b.

(2) Bolted connections are used primarily as mechanical fasteners for holding the component members of the bond in place. The connector bolts must be sufficiently tightened to maintain contact pressure required for effective bonding but shall not be overtightened. Table VIII of FAA-STD-019b provides the minimum torque guidance for the various bolt sizes of bolted connectors. Do not use bolts as direct bonds for high-frequency signals. Additional guidance for the use of bolted connections is given in paragraph 3.14.6 of FAA-STD-019b.

(3) Use rivets primarily as mechanical fasteners to hold two smooth, clean surfaces together or to provide a mechanical load bearing capability to a soldered bond. Do not use rivets as indirect bonds for high frequency signals. Riveted joints are adequate for personnel shock hazard protection provided the resistance does not exceed 0.1 milliohm.

(4) Sheet metal screws may not be used to provide a continuous and permanent electrical bond. They shall be used only to secure protective covers.

(5) Bonding straps, including jumpers, shall be in accordance with FAA-STD-019b.

d. Surface Preparation. All matting surfaces which comprise a bond shall be thoroughly cleaned before joining in accordance with paragraph 3.14.13 of FAA-STD-019b.

e. Dissimilar Metals. Coupling of dissimilar metals shall be in accordance with paragraph 3.14.12 of FAA-STD-019b.

f. Fasteners. Fastener materials for bonding aluminum and copper jumpers shall conform to the materials listed in table 5-5.

g. Completion of the Bond. If an intentional protective coating is removed from the metal surface, the matting surfaces shall be joined within 4 hours after cleaning.

h. Refinishing of Bonds. Bonds shall be refinished so as to match the existing finish as close as possible within the requirements of subparagraph 66(i).

i. Bond Protection. All bonds shall be suitably protected against weather, corrosive atmospheres, and mechanical damage. Under dry conditions, a corrosive preventive or sealant shall be applied within 24 hours of assembly of the bond materials. Under highly humid conditions, sealing of the bond shall be accomplished within 1 hour of joining.

(1) If a paint finish is required on the final assembly, the bond shall be sealed with the recommended finish. Care shall be taken to assure that all means by which moisture or other contaminants may enter the bond are sealed. A waterproof type of paint or primer conforming to FAA-STD-012a shall be used if the recommended finish is not waterproof.

(2) Locations not reasonably accessible for maintenance shall be sealed with permanent, waterproof compounds.

(3) If a paint finish is not required after assembly of a bond, a silicone or petroleum-based sealant shall be applied.

(4) Compression bonds between copper conductors or between compatible aluminum alloys and located in readily accessible areas not subject to weather exposure, corrosive fumes, or excessive dust shall not require sealing, subject to the approval of the contracting officer.

j. Bond Resistance. Unless otherwise specified in the contract documents, all bonds shall exhibit a maximum dc resistance of 1 milliohm as measured between the bonded members with a digital multimeter.

67. SHIELDING.

a. General. Protective shields for personnel, shielding to attenuate radiated signals and space separation of equipment and conductors shall be incorporated into the facility to minimize the coupling of interference. Under normal operating and environmental conditions, the bonding and grounding of metal structural components, building elements and the space separation of certain equipments and conductors as noted herein and in paragraph 3.15 of FAA-STD-019b are adequate.

TABLE 5-5. METAL CONNECTIONS FOR ALUMINUM AND COPPER JUMPERS

Metal Structure (Outer Finish Metal)	Connection for Aluminum Jumper	Screw Type	Connection for Tinned Copper Jumper	Screw Type
Magnesium and Magnesium alloys	Direct or Magnesium washer	Type I	Aluminum or Magnesium washer	Type I
Zinc, Cadmium, Aluminum and aluminum alloys	Direct	Type I	Aluminum washer	Type I
Steel (except stainless steel	Direct	Type I	Direct	Type I
Tin, Lead, and Tin-Lead solders	Direct	Type I	Direct	Type I or II
Copper and Copper alloys	Tinned or Cadmium plated washer	Type I or II	Direct	Type I or II
Nickel and Nickel alloys	Tinned or Cadmium plated washer	Type I or II	Direct	Type I or II
Stainless Steel	Tinned or Cadmium plated washer	Type I or II	Direct	Type I or II
Silver, Gold and precious metals	Tinned or Cadmium plated washer	Type I or II	Direct	Type I or II

Type I - Cadmium, zinc plated or aluminum
Type II - Pasivated stainless steel

b. Conductor and Cable Shielding. Signal lines shall be twisted, shielded pairs with the shield insulated. Cables consisting of multiple twisted pairs shall have the individual shields isolated from each other. Cable with an overall shield shall have the shield insulated.

c. Terminations of Individual Shields. Shields of pairs of conductors and the shield of cables containing unshielded conductors shall be terminated in accordance with the following:

(1) The shield shall be terminated at one end only. The length of unshielded conductors shall not exceed 1 inch (25mm). To meet this requirement, the length of the shield pigtail may be longer than 1 inch, if necessary, to reach the ground. The pigtail, however, shall be kept to a minimum length.

(2) Shield terminations shall employ minimum length pigtails between the shield and the connection to the bonding halo or ferrule ring, and between the halo or ferrule ring and the shield pin on the connector. The unshielded length of the signal line shall not exceed 1 inch (25 mm) with not more than 1/2 inch (13 mm) exposed length as the desired goal.

(3) Shields, individually and collectively, shall be isolated from overall shields of cable bundles and from equipment cases, racks, cabinets, junction boxes, conduits, cable trays, and elements of the multipoint ground system. Except for one interconnection, individual shields shall be isolated from each other. Care shall be exercised to assure that this isolation is maintained in junction boxes, patch panels, and distribution boxes throughout the cable run. When a signal line is interrupted such as in a junction box, the shield should be continuous. The length of unshielded conductors shall not exceed 1 inch (25 mm). To meet this requirement, the length of shield pigtail may be longer than 1 inch, but shall be the minimum possible.

(4) Nothing in this requirement shall preclude the extension of the shields through the connector or past the terminal strip to individual circuits or chassis if required to minimize unwanted coupling inside the equipment. Where extensions of this type are necessary, overall cable or bundle shields grounded in accordance with subparagraph 67c(3) shall be provided.

d. Termination of Overall Shields. Cables that have an overall shield over individually shielded pairs shall have the overall shield grounded at each end and intermediate points in accordance with the following:

(1) Shields of cables terminated to connectors shall be bonded in such a manner that the security clamp of the connector is carefully tightened to assure a low-resistance bond to the connector shell is achieved around the circumference of the cable shield. Prior to terminating the shield, the shield shall be carefully cleaned to remove dirt, moisture, and corrosive products. The bonds shall be suitably protected against weather, corrosive atmospheres, and mechanical damage. Under dry conditions, a corrosive preventive or sealant shall be applied within 24 hours of assembly of the bond materials. Under highly humid conditions, sealing of the bond shall be accomplished within 1 hour of joining.

(2) Cables which penetrate walls or panels of cases or enclosures without the use of connectors shall have their shields bonded to the penetrated surface using a type 4 bond strap that encircles the cable shield and is connected to the enclosure with a suitable bolted connector. Ensure that the shield is clean and that the strap is securely tightened to the shield to provide a good ground.

(3) Grounding of overall shields to terminal strips shall be by utilization of a bonding halo or ferrule at the end of the overall shield which in turn is connected to a terminal on the strip with a #16 AWG or larger conductor whose length shall be 2 inches (5.1 cm) or less. The terminal or the terminal strip will be firmly and suitably connected to the equipment case.

(4) Where the cable continuity is interrupted, such as in the junction box, the shield shall be carried through and grounded at the box. The length of the unshielded conductors shall not exceed 1 inch (25 mm). To meet this requirement the length of the shield pigtail may be longer than 1 inch, if necessary to reach the ground, but shall be kept to minimum length.

(5) The design and layout of facilities shall physically separate equipment and conductors which produce interference from equipment and conductors which are susceptible to interference. In general, equipment and conductors which carry, produce, or use high levels of current, voltage, or power, including pulse power, produce interference. Equipment and conductors which carry, produce, or receive low voltage or power levels are susceptible to interference.

(6) All electrical wiring and equipment shall be installed in accordance with the National Electrical Code and Specification FAA-C-1217e, Electrical Code.

SECTION 4. SITE REQUIREMENTS

68. REQUIREMENTS OF A SATISFACTORY VHF/DF SITE. The ideal site for the DF antenna system is one which is clear of obstacles so that line-of-sight contact with target at long ranges, 80-320 km (50-200 miles), and/or with low flying aircraft at short ranges may be achieved. The surrounding skyline should subtend an angle of 1 degree or less with the antenna.

a. The general vicinity should be free of metallic objects such as large buildings and water towers, and of wooded areas or anything which obstructs line of sight visual contact with the target craft. Refer to table 5-6 for specific restrictions.

b. The general vicinity should be clear of other antennas, particularly transmitting equipment.

c. The immediate area should be free of metallic objects such as metal fences, power lines, or telephone lines that may act as reflecting and/or re-radiating elements.

d. The antenna must be located within 600 m (2,000 feet) of the receiver bearing processor.

e. The earth surrounding the DF antenna should have uniformly high conductivity and equal moisture content. Areas evenly covered with grass or vegetation usually meet this requirement. Rocky or sandy soil has low conductivity; however, an area with uniform low conductivity is preferable to an area of high conductivity which is spotted with rocks or sand or has varying moisture content.

f. Regions abruptly showing bare spaces of the earth should be avoided. Such spaces usually indicate the presence of rocks or mineral outcroppings or underground streams.

g. Information for collocating the FA-10121 VHF/DF with other in-band and out of band transmitters is presented in paragraph 69.

69. ELECTROMAGNETIC COMPATIBILITY SITING CRITERIA. The following paragraphs define siting criteria for VDF systems collocated with VOR's, remote communications air-ground (RCAG) facilities, backup emergency communications (BUEC), remote communication outlets (RCO), and tactical air navigational aids (TACAN). Also included in this discussion is an analysis for strong out-of-band signals in the FM broadcast and VHF-TV bands and overload protection.

> **NOTE:** It is important to stress here that the information in this section pertains to the performance of the VHF DF equipment only. When a DF system is collocated with another facility, its installation shall conform to the siting criteria of the collocated facility. As an example, Order 6820.10, VOR, VOR/DME, and VORTAC Siting Criterion, does not allow structures within 1,000 feet of a VOR facility.

a. Collocated Transmitter Analysis. The following assumptions have been made for this analysis.

(1) In-band transmitters are 500 ft or more away.

(2) VOR (108-118 MHz), BUEC, RCAG, RCO (118-137 MHz).

(3) VOR filtering 1 dB @ 118 MHz to 15 dB @ 108 MHz.

(a) Example 1. A VOR transmitting on 108 MHz 500 feet from the VDF array. A transmitter @ 118 MHz producing a field strength of 100,000 microvolts/meter at the VDF array. In this case, third-order intermodulation products would be created at 98 and 128 MHz. The fields required to produce intermodulation products at 128 MHz to be the same output level as those provided by a 5 microvolts/meter (minimum desired VDF signal strength) are 100,000 microvolts/meter for the 118 MHz signal and 560,000 microvolts/meter for the 108 MHz signal. The power level for a VOR transmitter to produce a field strength of 560,000 microvolts/meter at a distance of 500 feet is 245 watts. Maximum output power of a VOR is 100 watts.

FIGURE 5-14. VDF ANTENNA SITING

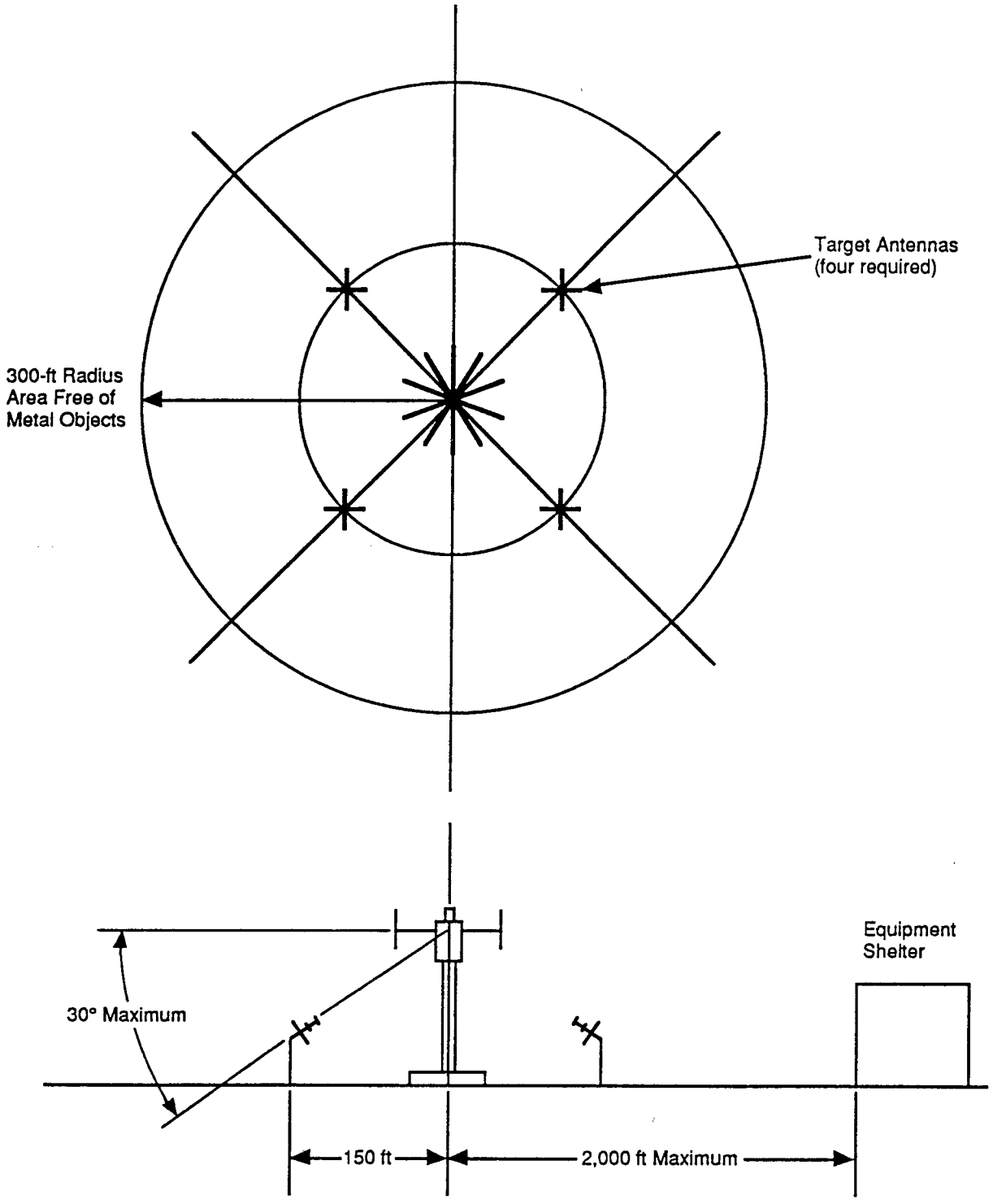


TABLE 5-6. GUIDELINES FOR A GOOD (±3°) AIRPORT VHF/DF SITE

Class and Number of Features	Description	Requirement (Minimum Distance)	Remarks
I (a)	Ground surface near site	Smooth to within ±0.3 m to radius of 50 m	
I (b)	Ground slope	±1 degree or less to 50 m radius	
I (c)	Ditches, bank	50 m	
I (d)	Trees & woods	Small: 50 m Large: 100 m Forests: 200 m	
I (e)	Cliff faces (Visible from site)	Minimum: 1 km	Effects comparable to large metallic hangers
I (f)	Hills and mountains	Site should be level and high in relation to surroundings	Effective range will be limited to line-of-site and accuracy may be affected by reflections
I (g)	Rivers, lakes, and seas	Ref. I(c) & (e)	Effect of water negligible, but consider banks and cliffs
II (a)	Vertical conductors metallic masts chimneys	100 m	For conducting structures exceeding 7 m in height, separation should be increased in proportion as far as possible

This table, which is useful in defining site conditions, is abstracted from Publication No. C4-2VHF/DF-3, Navaids and Avionics En Route Systems, Doppler VHF/DF Site Selection, Telecommunications and Electronics Branch, Transport Canada, March 1, 1976.

TABLE 5-6. GUIDELINES FOR A GOOD (±3°) AIRPORT VHF/DF SITE (CONTINUED)

Class and Number of Features	Description	Requirement (Min. Distance)	Remarks
II (b)	Cable (surface or buried)	No restriction	
II (c)	Wire fences (mesh or separate wires on wood or metal posts)	100 m	Long straight wire fences can affect the accuracy over wide sectors on each side of the normal from the DF to the fence
II (d)	Overhead lines up to 9 m in height	200 m	For higher lines the the separation should be in proportion to height increase
III (a)	Small isolated bldgs (non-metallic) normal size less than 3 m tall	75 m	Brick, stone, or timber with normal complement of wires and pipes. For similar larger buildings separation should be proportional to height increase in excess of 3 m.
III (b)	Isolated farm bldgs or dwelling houses of non-metallic construction	200 m	
III (c)	Small sheet-metal or reinforced concrete buildings of normal proportions less than 3 m high	200 m	Separation from larger metallic buildings to be increased at least in proportion to height
III (d)	Parking areas for small numbers of motor transport vehicles	200 m	

TABLE 5-6. GUIDELINES FOR A GOOD (±3°) AIRPORT VHF/DF SITE (CONTINUED)

Class and Number of Features	Description	Requirement (Min. Distance)	Remarks
III (e)	Built-up areas: groups or rows of 2 story buildings of non-metallic construction	500 m	
III (f)	Aircraft Hardstandings	500 m	May be closer for smaller lighter aircraft hard-standings
III (g)	Large hangars of sheet metal or reinforced concrete construction	Preferably 1 km	Minimum separation may be reduced somewhat if hang-ar orientation is favorable
IV (a)	Runways	No restriction other than com-pliance with zoning require-ments	Effects of moving air-craft are transient and usually negligible at permitted distances
IV (b)	Railways	500 m	Permanent right-of-way as such have no effect. Embankments will affect high elevation perform-ance. Separation is suf-ficient to guard against ancillary effects.
IV (c)	Roads with moving vehicles	100 m	Ref. IV (b) Remarks. Parking prohibited within 200 m. Ignition noise rarely troublesome at 100 m. Usually undetect-able with normal suppression.

TABLE 5-6. GUIDELINES FOR A GOOD (±3°) AIRPORT VHF/DF SITE (CONTINUED)

Notes on the use of the table - These notes serve to explain the preceding restrictions as laid out in the table.

Feature I (b) - For accurate bearings on signals arriving at high angles of elevation a smaller slope would be preferred, but for most purposes the 1 degree standard is sufficient and is often the best that can be obtained when all other factors have been taken into account.

Feature I (d) - Since the range of the direction finder is substantially limited to aircraft above line-of-sight, a dense wood or forest may be expected to limit the working range if the tree-tops have an appreciable angle of elevation when viewed from the DF site. This is undesirable in itself, and will tend to increase site errors on aircraft at low elevations beyond the trees, since the "wanted" signal will be attenuated while scattered signals reaching the DF from more elevated obstructions around the site will not suffer a corresponding attenuation.

Feature I (e) - Effects com[parable to those of large metallic hangars if cliffs are smooth, straight, and nearly vertical but effect is heightened if they are also long. MAXIMUM separation is desirable.

(b) Example 2. Maximum power required to produce third order intermodulation products to be less than the noise floor level of the VDF system (approximately 120 dBm). With an input third order intercept point of +28 dBm, a field strength of approximately .05 volts/meter would be required. To prevent this condition, maximum transmitter power should be less than 1.9 watts with the transmitter 500 feet away.

(c) Example 3. The maximum power required to produce third-order intermodulation products of 6 dB or less than the level produced by a 5 microvolts/meter VDF signal (approximately 106 dBm), using an input third order intercept point of +28 dBm, is a field strength of .08 volts/meter. The maximum power to prevent this condition is 5.0 watts or less for transmitters 500 feet away.

(d) Example 4. Maximum power required to prevent amplifier desensitization (by exceeding the 1 dB gain compression point). The 1 dB gain compression point of the system at the modulator input is approximately +10 dB (for signals outside the switched filter passband). The field strength required to meet this condition is approximately 1.6 volts/meter. The maximum transmitter power should be less than 1980 watts for transmitters 500 feet away to prevent this condition.

(e) Example 5. Signals of 100,000 microvolts/meter could potentially produce third-order intermodulation products of approximately the same level as those created by a 5 microvolts/meter signal.

(f) Example 6. TACAN's 962-1215 MHz 500 feet away. Bandpass filters precede the active circuitry providing at least 40 dB of attenuation to these frequencies. Field strength levels of approximately 5 volts/meter would create intermodulation products equal in level to the receiver noise floor. TACAN transmitters should have a maximum power of less than 19,355 watts (equivalent radiated power) to prevent this condition.

b. Strong Out-of-Band Signals Analysis. The following subparagraphs provide the results of an analysis on strong out-of-band signals. Table 5-7 shows the results of the analysis for transmitters of .5 to 4 miles from the VDF antenna. The contractor made the following assumptions in performing this analysis.

(1) The signals most likely to cause interference are FM Broadcast (88-108 MHz) and VHF-TV (54-88 and 174-216 MHz).

(2) Calculations are based upon 100,000 watt outputs and vertically polarized antennas. (These signals are horizontally polarized in reality).

(3) Assumes that the frequencies of two carriers are such that a third order intermodulation product could occur in the DF channel being monitored.

(4) The modulator circuitry has an input intercept point of +28 dBm preceding the switched filter.

TABLE 5-7. SYSTEM STRONG SIGNAL PERFORMANCE VS. BROADCAST FM AND VHF-TV

Transmitter Distance (Miles)	Transmitter Distance (Meters)	Power Density (W/m2)	Field Strength (V/m)	Condition	Filter Rejection Required(dB)
.5	805	.012	2.15	1	33.3
.5	805	.012	2.15	2	28.6
1.0	1609	.003	1.08	1	27.3
1.0	1609	.003	1.08	2	22.7
2.0	3219	.0008	0.54	1	21.3
2.0	3219	.0008	0.54	2	16.7
4.0	6437	.0002	0.27	1	15.3
4.0	6437	.0002	0.27	2	10.7

Condition 1 = IM products level at the system noise floor

Condition 2 = IM products 6 dB below the level created by a signal with a field strength of 5 microvolts/meter

Results:

1. If signals in the FM Broadcast or VHF-TV band are attenuated by 15 dB in the antenna array:

   a) signals from broadcast transmitters 4 miles or more away will not create intermodulation products exceeding condition 1; and

   b) signals from broadcast transmitters 2 miles or more away will not create intermodulation products exceeding condition 2.

2. Realistically, the vertically polarized portion of the broadcast signal will be weaker than the horizontally polarized signal by at least 10 dB. This would make intermodulation products fall below the system noise floor for broadcast transmitters more than 1.5 miles from the DF array.

(5) Attenuation is equal to free space loss.

c. Overload Protection Analysis. The following assumptions were made for the overload protection analysis.

(1) Signal levels (within 118-137 MHz) of 20 V/m will produce a signal level of approximately 9 volts at the antenna modulator input, based on antenna element gain tables, the FRIIS transmission formula, and antenna array gain calculations.

(2) The limiter circuit (4 diodes) will limit the RF voltage to approximately 1 volt root mean square (RMS).

(3) The impedance of the source (antenna array) is approximately 50 ohms.

(a) The power dissipation of the limiter will be approximately 160 milliwatts (or 40 milliwatts/diode).

(b) The output level of the limiter will be approximately 1 volt (RMS) or +13 dBm. The maximum input rating of the preamplifier (QBH-137, Q-BIT Corp.) is 2 volts (RMS).

(c) An RF level of +13 dBm will drive the preamplifier into gain compression, and its output will be approximately +22 dBm.

(d) The level of +22 dBm will be attenuated by approximately 3 dB in the (passive) two-way combiner (+19).

(e) The bandpass filter is capable of handling +19 dBm signals. The insertion loss of this module is approximately 5.5 dBm (+13.5 dBm).

(f) An RF level of +13.5 dBm will drive the cable drive amplifier into gain compression, and its output will be approximately +22 dBm.

(g) The step attenuator, with component derating, can handle approximately .5 watts (+27 dBm) and will handle the input level of +22 dBm. The combined loss of the step attenuator and antenna to receiver cable will be adjusted to approximately 11 dB, which will present a level of approximately +11 dBm to the receiver input. The protection circuitry in the receiver will handle this level.

d. Testing at the FAA Technical Center (in Atlantic City, New Jersey). Testing was conducted on the FA-10121 DF collocated with VHF transmitters at a VORTAC site. The transmitters were spaced at various frequencies throughout the band and were on simultaneously. The DF antenna was moved to 250 feet of the VHF transmitting antennas before experiencing difficulty in providing usable bearings to the operator. Testing was also conducted at 500, 1,000, 1,500, and 2,000 feet from the transmitting antennas with no interference to the DF receiver. It is recommended that the DF antenna be placed at least 500 feet from any VHF transmitter.

SECTION 5. EQUIPMENT SET UP AND TURN-ON PROCEDURES

70. INITIAL EQUIPMENT TURN-ON AND SET-UP PROCEDURES. Paragraphs 71 through 73 describe activities which must be completed at the antenna site before commissioning the site. Technicians performing this activity shall have completed maintenance training on the FA-10121 VDF equipment and shall be familiar with its operations.

71. RECEIVER RACK TURN-ON PROCEDURES. The following steps provide instructions for initial turn-on of the VDF antenna site equipment. They should be performed in the order presented.

a. Verify that all cable connectors are firmly fastened.

b. Verify that all semirigid interconnect RF cables on the front panel of the Receiver-Controller and in the Antenna Electronics box are secure.

c. Verify that all 110 Vac and 24 Vdc power connectors and cables are firmly fastened.

d. Turn "on" BCPS ac input 20 A switch (the BCPS is located in the bottom of the receiver rack).

e. Turn "on" BCPS power supply output switch and the battery charger switch. The BCPS "on" indicator and the BATT "on" indicator should be illuminated.

f. Depress BCPS "reset" button.

g. Depress battery "reset" button.

h. Turn the modem switch located on the 24 Vdc distribution panel (located at the top of the receiver rack) to "on." The indicator lamp should be illuminated.

i. Turn the antenna switch located on the 24 Vdc distribution panel to "on." The indicator lamp should be illuminated.

j. Turn the receiver switch located on the 24 Vdc distribution panel to "on." The indicator lamp should be illuminated.

k. Turn the filter switch located on the 24 Vdc distribution panel to "on." The indicator lamp should be illuminated if the preamplifier/filter is used. The ac input meter and dc output needles of the BCPS meter should indicate an upscale reading.

72. PREAMPLIFIER/FILTER TURN-ON PROCEDURES. The following steps describe the turn-on procedures for the preamplifier/filter. If the preamplifier/filter is not used, disregard subparagraphs 72a through 72c.

a. Open the door and energize the main power circuit breaker CB2 on the Power Entry Assembly. Each circuit breaker is energized by pushing "in."

b. Observe that the associated green LED indicator DS2 on the Power Entry Assembly illuminates, as well as green LED indicators DS2, DS3, and DS9 on the Interface Assembly. Also green LED indicator DS1 on the Preamplifier/ Attenuator should illuminate. None of the red LED indicators on either the Interface Assembly or the Preamplifier/Attenuator should illuminate.

c. Energize the auxiliary power circuit breaker CB1 on the Power Entry Assembly. Immediately the associated green LED indicator DS1 should illuminate and all three motor gear assemblies can be observed in rotation as the stubs retract to their upper electrical limit. At this point rotation will pause and all three motor gear assemblies will reverse rotation as the filter tunes to channel 141. Then all activity will cease. There should be no red LED's illuminated in the preamplifier/filter.

73. RECEIVER AND PREAMPLIFIER/FILTER INITIALIZATION AND CHECK-OUT PROCEDURES. The following subparagraphs describe the initialization and check-out procedures for the receiver and preamplifier/filter.

a. IOT-3 Initialization. Connect the RS-232 cable connector between the receiver/processor rack and the RS-232 connector on the back panel of the IOT-3. Upon verification that the floppy disk drive contains no disk or head protection sheet, turn on the ac power. The system will initialize itself automatically from the hard disk. A detailed description of the IOT-3 maintenance functions may be found in TI 6530.10, Volume 1. Included here are those functions relating to installation and calibration.

(1) The system adjustments, parameter settings, and verification of proper system operation are accomplished through the keyboard control of the IOT-3 while viewing the screen. This begins with the VDF Logon Screen. This screen is not displayed immediately after turning on the main power switch. Instead, the four-lighted indicators are illuminated, and a message is displayed in the upper left portion of the screen, indicating that system memory is being checked. The numeric value contained within the message increases as the random access memory (RAM) is checked.

(2) When the memory check is completed, the indicators are automatically dimmed, and a series of messages appear on the screen. The messages indicate that portions of the operating system software are being loaded into memory from the hard disk. After the software is loaded, and following a brief pause, the logon screen is displayed (see subparagraph 73b). If you enter your name or password incorrectly, you can erase your entry by selecting the CANCEL INPUT key before depressing RETURN.

(3) Upon successful logon, the system will return a display of the IOT-3 RMMC Main Menu. The VDF antenna site operations test can begin from this screen. Your progression from this screen will depend upon the tasks you perform at the local site. The IOT-3 screens you view share the format of the screens displayed on the IOT-2 when the RMMC system is operated from the remote site. The RMMC tasks being performed at the local site are the same tasks that are performed at the remote site, e.g., increasing the value of the antenna gain parameter results in the same action whether commanded from the remote or local site.

b. IOT-3 VDF Logon Screen. Initial display of the VDF Logon Screen includes a single prompt for your operator name. Once you enter your name and depress RETURN, the display changes to include a prompt for your password (see figure 5-15). After entry of your password (masked on the screen) and depression of RETURN, logon display remains but changes a second time to include a prompt for DF site entry (see figure 5-16) as well as date and time.

(1) In response to this prompt, the three-letter location identifier of the site under test will be entered and the RETURN key depressed. The screen display changes to that of the IOT-3 RMMC Main Menu (see figure 5-17). The entered DF site is immediately displayed in the status display area of the screen. The system message area displays a message to indicate a successful logon.

(2) With the RMMC Main Menu displayed, you may proceed to any screen to perform the needed tasks. You must first, however, access the RMMC Mode Menu to change the terminal mode from idle to primary.

c. IOT-3 RMMC Mode Menu. The RMMC Mode Menu (see figure 5-18) is accessed from the IOT-3 keyboard using the hard function key, RMMC Mode (CONTROL + F7). The screen includes a display of two mode options, idle and primary. A backup mode option is not given, because the RMMC system operating from the local site does not include a backup configuration. The IOT-3 must be placed in primary mode if it is currently in idle mode. Highlight the appropriate selection and depress F1 to initiate mode. F12 will return you to the main menu.

d. IOT-3 RMMC Main Menu. The first option is highlighted, indicating the cursor position. To move the cursor to another option, depress the alpha key corresponding to the screen option or depress the downward cursor position key until the desired option is highlighted. As the highlighted option changes, so does the single line of explanatory remarks.

(1) If you have moved the cursor downward to another option, and then realized that you need to choose an option listed above the present position, depress the upward cursor positioning key until the needed option is highlighted.

(2) The soft function key, F1 SELECT MENU, is depressed when the desired option is highlighted. It is the only soft function key which can be used from this menu.

e. IOT-3 DF Facility Control Menu. The DF Facility Control Menu (see figure 5-19) is displayed when the Control option (Option A) is selected from the RMMC Main Menu. The menu displays the current settings of DF Control Parameters. From this display, you can change the settings and direct the system to verify Control Parameter values with readings taken at the site. The local site corresponds to the site listed in the status display area of the screen.

(1) The menu path (A) is shown at left on the line below the screen title. It indicates that you have chosen Option A from the RMMC Main Menu.

FIGURE 5-15. VDF LOGON SCREEN (PASSWORD PROMPT)

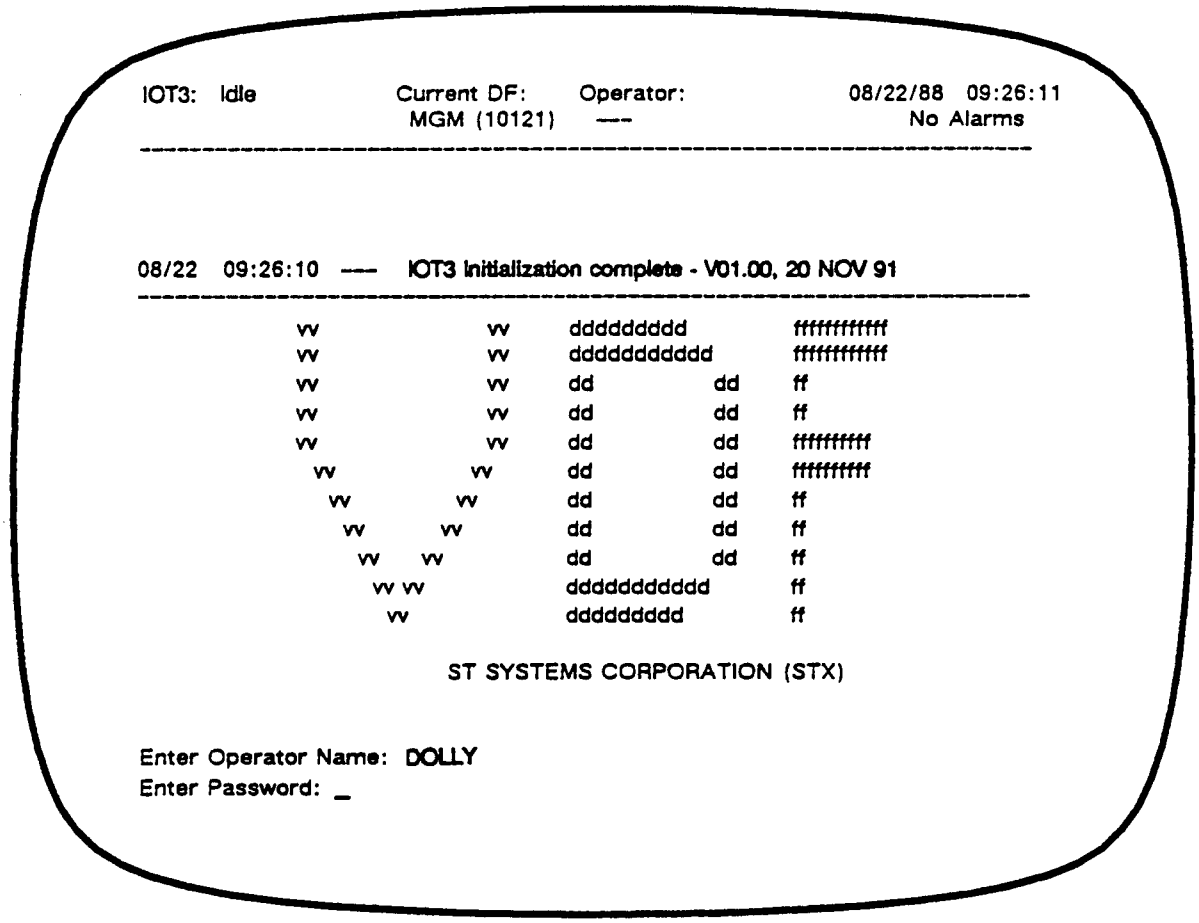


FIGURE 5-16. VDF LOGON SCREEN (DF SITE PROMPT)

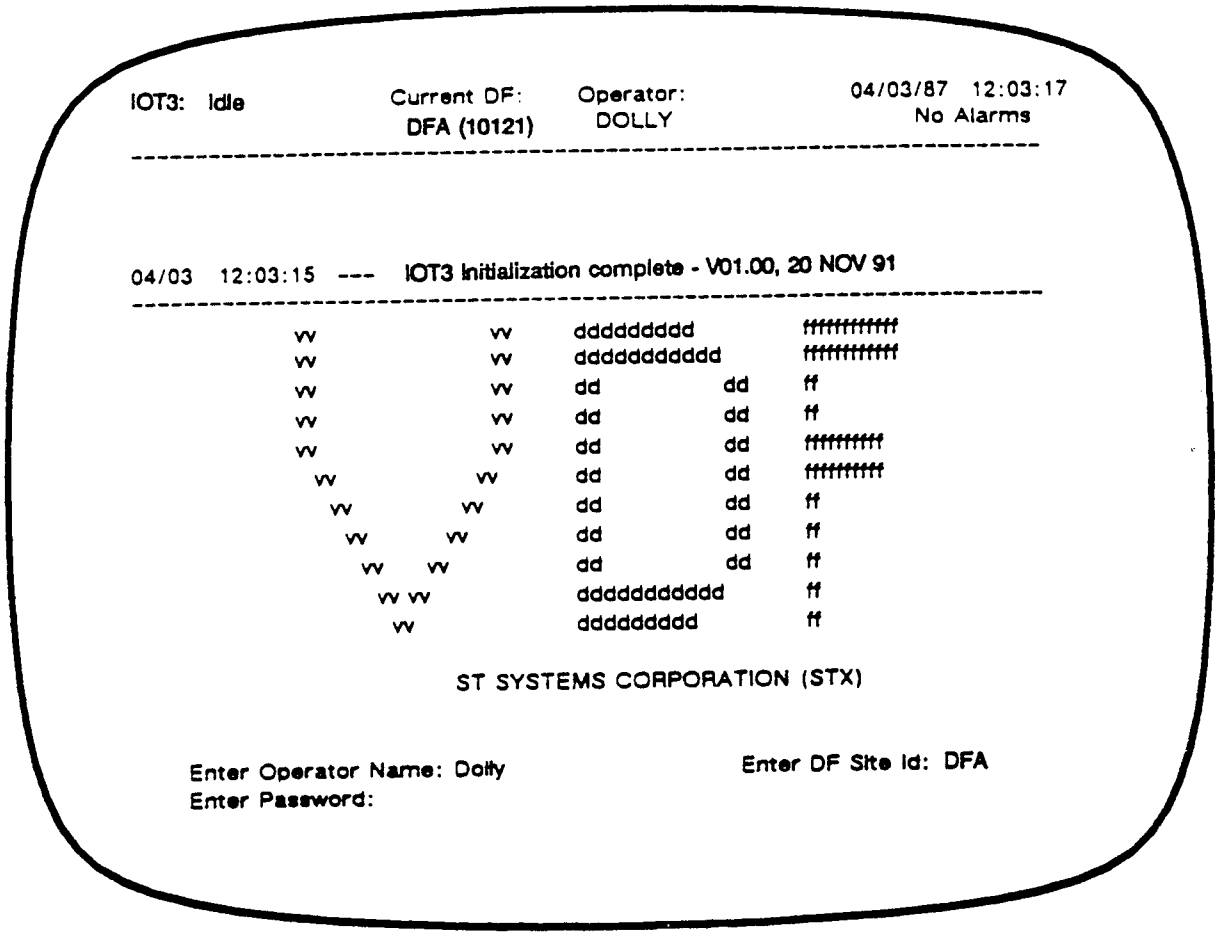


FIGURE 5-17. RMMC MAIN MENU (IOT-3)

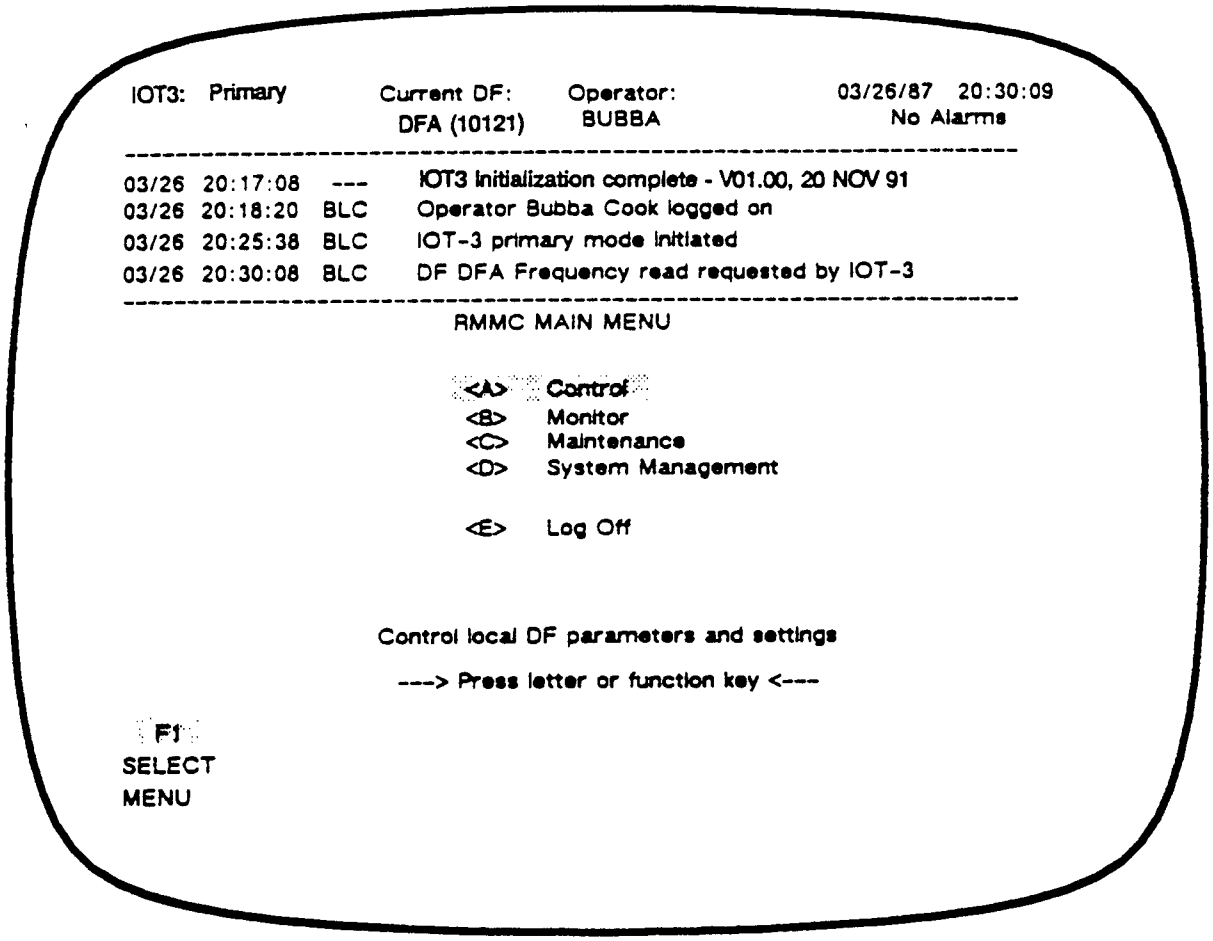


FIGURE 5-18. RMMC MODE MENU (IOT-3)

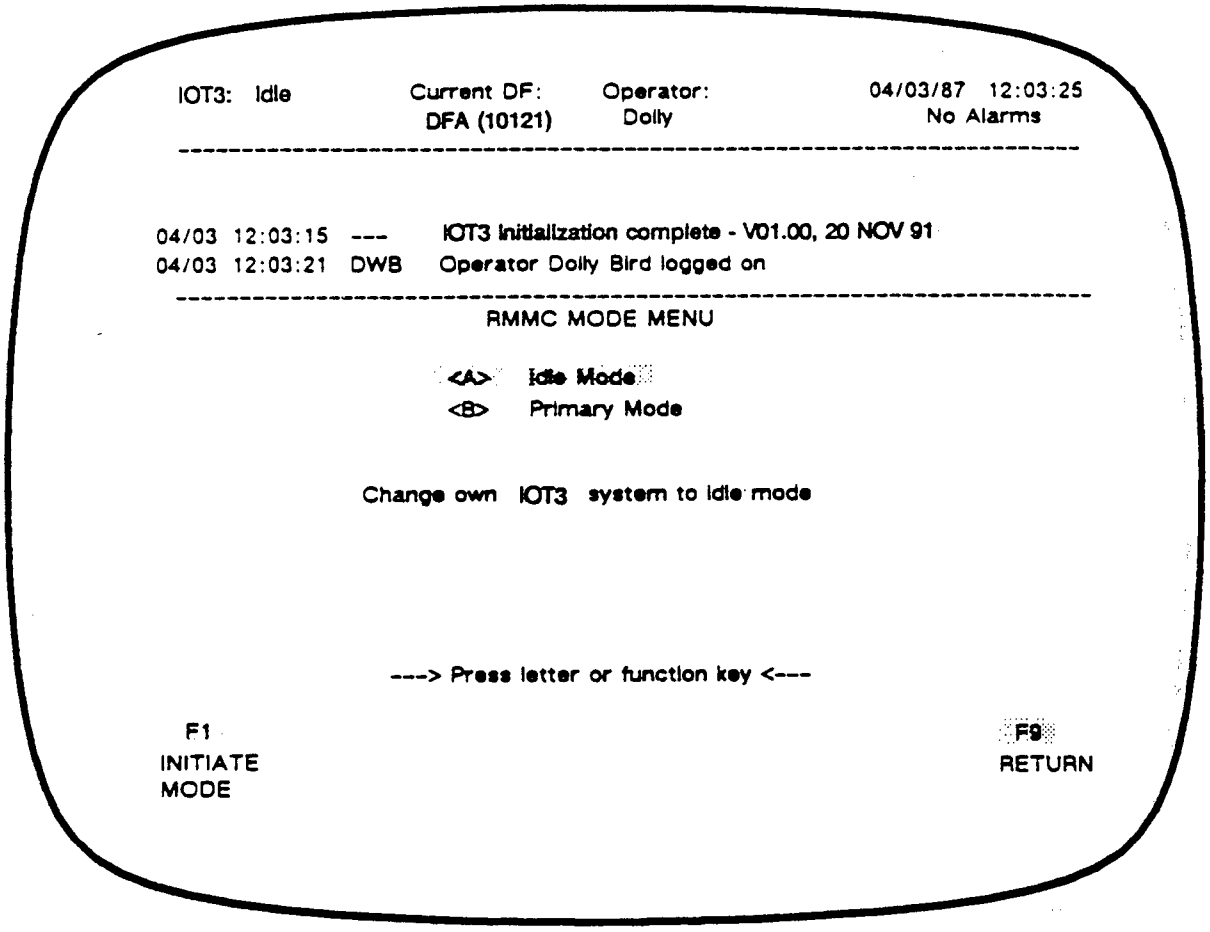
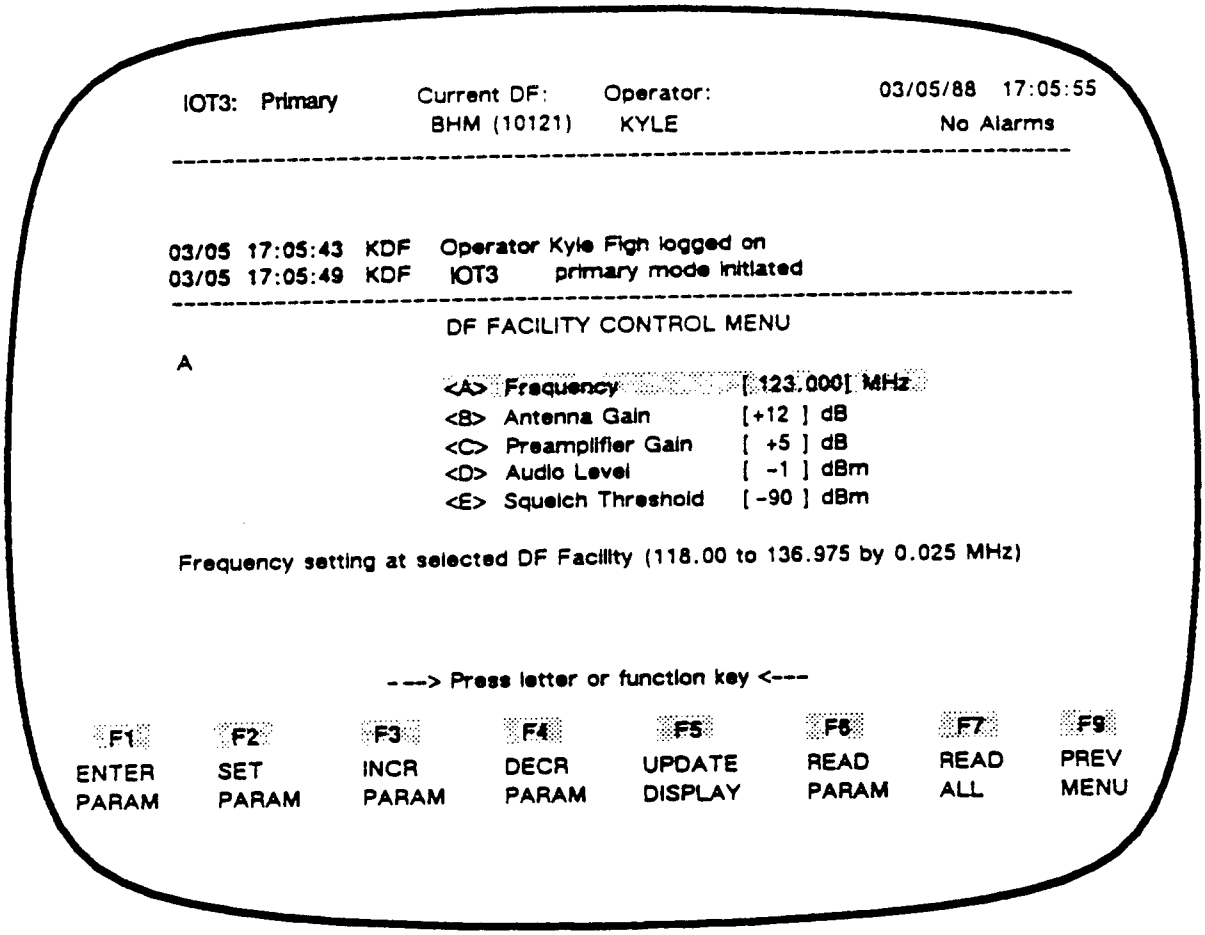


FIGURE 5-19. VDF FACILITY CONTROL MENU (INITIAL DISPLAY)



(2) The first parameter value, frequency, is highlighted. Its present value is shown within the brackets. The explanatory remarks indicate the acceptable frequency range of 118.000 to 136.975 MHz.

(3) If frequency is not the parameter value you wish to consider, reposition the cursor to the desired option by either the downward cursor key or by the alpha key corresponding to the screen option.

(4) As each Control Parameter is highlighted, its range of acceptable values is shown on the remarks line. This feature enables you to avoid entering out-of-ranges values.

(5) When the desired parameter is highlighted, select one of the soft key functions shown on the screen display. Each function, with the exception of the exit function, F12 PREV MENU, is discussed in turn. (The exit function returns you to the RMMC Main Menu.)

F1 ENTER PARAM: Enter Parameter clears the highlighted value and allows you to type in a new value. After the new value has been entered, press RETURN. The input will be accepted on screen if it was within the acceptable range of values. If an out-of-range value is entered, an error message is displayed and the former value is returned to the screen.

F2 SET PARAM: Set Parameter requests the system to change the parameter value to the one just entered with F1. Until the Set Parameter function is invoked, the newly-entered value is only a screen display. To change a parameter in the system, F1 and F2 must be used in conjunction with one another. Therefore, the proper sequence is F1, enter desired value, RETURN, and F2. Updated parameters can be verified by observing the System Update Area above the screen title.

F3 INCR PARAM: Increase Parameter is used to increase the displayed value by an incremental value. It is depressed repeatedly until the desired value is displayed. This key is used in conjunction with F2 Set Parameter in order to request a system parameter change.

F4 DECR PARAM: Decrease Parameter is used to decrease the displayed value by an incremental value. It is depressed repeatedly until the desired value is displayed. This key is used in conjunction with F2 Set Parameter in order to request a system parameter change.

F5 UPDATE DISPLAY: Update Display is used to display the parameters with their current values. Only values entered using F2 Set Parameter are updated. Any changes made to the system parameters from another site, i.e., the controlling AFSS, will not be represented by using Update Display alone. A read parameter command must first be used (see function F6).

F6 READ PARAM: Read Parameter is used to request the reading of one selected parameter value from the DF site. The result is a reading of

the current value by the local RMMC. This function can be used to verify system acceptance of newly set parameters and to verify a parameter value prior to change. It is necessary to use a read command to monitor a parameter value that has been changed from another site.

F7 READ ALL: Read All is used to request a reading of all the parameter values on the DF Facility Control menu. Its functionality is similar to F6 Read Parameter.

f. Individual DF Site Control Parameters. The control parameters must be correct for each specific site for proper operation.

(1) Frequency is self explanatory and can be changed by a number of conditions. The receiver's frequency range is 118.000 to 136.975 MHz in 25 KHz steps.

(2) Antenna gain is used to offset the line loss in the RF cabling from the receiver to the antenna. A larger value allows the antenna electronics to amplify signals the greatest. It is recommended to set this value at the maximum +31 dBm. If in any event the receiver becomes overloaded due to strong signals the antenna gain can be decreased to rectify this condition. This condition may occur when the cable length between the receiver and antenna is at a minimum.

(3) The preamplifier gain sets the gain for the preamplifier/filter. Internally the filter has approximately 6 dB of gain to offset any signal losses which may occur in the filter. This control allows the maintenance person to set the gain if necessary. The available range is 0 to 20 dB and the recommended setting for this control is 0 dB.

(4) The Audio Level sets the output of the modem sending information from the receiver site to the RMMC modem in the AFSS. The available range is -16 to 0 dBm in 1 dBm steps and the recommended setting is -16dBm.

(5) The squelch threshold sets the squelch circuits to operate at a selected received signal level to provide adequate pilot audio to the DF operator. The recommended setting for this value is -140dBm.

(6) Filter in/out indicates if the filter is physically installed in the circuit. The value is toggled between INLINE and BYPASS using F1 and F2 in sequence.

g. Site File Parameters. After the control parameters have been set, certain site file parameters must be set by selecting the System Management Menu from the IOT-3 RMMC Main Menu.

h. Modify DF Site File Screen. Choose option <B> from the System Management Menu which is the FSS File Maintenance screen. Choose option <B> DF Site File from the FSS Site File Maintenance Menu by pressing F1 Modify File. The screen comes up as Modify DF Site File Screen. This screen allows the maintenance technician to install the initial DF site parameters into the

local RMMC software for initial tests.

<A> RECORD # [1]

<B> INSTALLED [Y]

<C> TYPE [FAC] This identifies the type of equipment as FA-10121. For an FA-9964 enter "9964"

<D> SITE ID [DFA] This is the 3 letter site location identifier for the receiver site

Records <E> through <Q> are defined as follows:

<E> DFLT FREQ [121.500] This is the default frequency of the DF SITE which is usually set to the emergency frequency of 121.500 MHz

<F> LATITUDE This is the latitude of the DF antenna in degrees, minutes and seconds (no fractions of seconds)
EXAMPLE <038-52-18N>

<G> LONGITUDE This is longitude of the DF antenna in degrees, minutes and seconds (no fractions of seconds)
EXAMPLE <092-10-24W>

<H> through <Q> OPERATIONAL PRESET FREQUENCIES
These are the 10 preset frequencies which will be supplied to the IDCU (the IDCU is not used in the initializing and check-out of the DF SITE prior to site calibration; this is the same screen which is supplied to the IOT-2 when this menu is called).

Function key F6 allows the technician to display the second screen of the DF SITE FILE menu and the explanation of each record follows:

<A> ANTENNA OFFSET This value is determined by the site calibration procedure to align a dipole electrically to magnetic north. The site calibration procedure follows this discussion

<B> PORT ID This is the location of the port where this particular DF SITE's modem is terminated at the RMMC rack

<C> BAUD RATE This is the baud rate used by the DF SITE modem and shall be set to 600 for the FA-10121 or 300 for the FA-9964

<D> FILTER INST This record is used by the system to note if the preamplifier/filter is physically installed in the system

<E> MAGNETIC VARIATION This record is taken from sectional maps of the DF SITE to supply the site's magnetic variation

<F> through <I> These are the locations of the target transmitters. If less than four are used "999" is placed in the unused target antenna locations. If a 9964 is installed, "999" is placed in all of the locations

<J> through <S> These are the 10 certification frequencies for the site. These frequencies are used for recordkeeping and trends. SITE certification is only valid for a frequency of 135.850 MHz. Single frequency certification tests may be performed using the system certification tests menu.

The previously described parameters except for Antenna Offset and Operational Preset Frequencies must be set correctly prior to performing the site calibration procedures. Antenna Offset is determined by the site calibration procedures and the Operational Preset Frequencies can be determined after the IDCU and RMMC equipment have been installed.

i. Save Parameters and Exit. After the parameters have been correctly set into their records, press F9 to save changes and exit from the FSS File Maintenance screen back into the System Management Menu.

j. System Management Menu. From the System Management Menu choose option <A> DF Site Management. From the DF Site Management Menu choose option <B> startup DF site. This places information stored in the FSS File Maintenance records to their appropriate locations in the DF Receiver FCPU software. Site calibration can now be performed.

74.-79. RESERVED.

CHAPTER 6. SITE CALIBRATION PROCEDURES

80. INTRODUCTION. This chapter provides general guidance for site calibration. The FA-10121 VDF is able to, within limits, eliminate azimuth error inherent in DF systems due to site anomalies as well as electrical imbalances in the antenna system. Essentially, a microprocessor is given an array of correction values via a PROM. Thereafter, when the system recognizes a target on a radial, subject to error, it will adjust the displayed radial to remove the error.

81. SITE CALIBRATION APPROACH. The site must be surveyed with a transit and accurate five degree multiples, referenced to true north, staked out at a range of 150 feet from the main antenna array. A mobile signal source (comb generator) is then moved to each of the surveyed points and the displayed radial of the signal source is noted. The signal source should be raised above nearby obstacles to alleviate reflections. Using 10 frequencies this produces 720 separate error data points. The errors are keypunched into the computer via special software. After the error data is stored into the computer, another program automatically burns the error data into a PROM. The PROM is then permanently installed into the receiver/processor group. An alternate method for performing the site calibration without the use of the comb generator is provided in paragraph 83.

82. SITE CALIBRATION PROCESS. Subparagraphs 82a-82n describe the site calibration process to be performed after installation of the FA-10121 VDF.

a. The following is a list of equipment needed for the site calibration procedure.

(1) IBM-AT or equivalent computer (IOT-3).

(2) Calibration software provided by the contractor; FAARMC Program (FAA Remote Monitor Computer), and GENCOR Program (Generate Correction).

(3) Comb generator, supplied by the contractor (part number 2006600).

(4) Properly installed VDF system.

(5) PROM Burner, Intel, Model iUP-201A with iUP FAST 27k Personality Module (or equivalent).

(6) PROM Eraser, UVP Model DE-4 (or equivalent).

NOTE: Subparagraphs 82a(5) and 82a(6) are not supplied by the contractor.

b. Prior to site calibration, verify that the VDF system has been installed properly and that the installation site has surveyed markers (±.1 degree) 150 feet from the center of the main antenna for each five degree increment.

c. The comb generator will be used to facilitate automatic testing during the system test portion of the site calibration. It provides 10 test

frequencies (118 MHz, 120 MHz, 122 MHz, 124 MHz, 126 MHz, 128 MHz, 130 MHz, 132 MHz, 134 MHz and 136 MHz) which are used to calibrate the VDF system.

d. The comb generator's antenna is used to radiate the signal to the main array during the calibration process.

e. Ensure that power is off to the VDF system. Remove the PROM (UNIT 8-4A15A1U4) from MCP-A and replace MCP-A unit in receiver rack. Erase the PROM and save for use in later steps.

NOTE: The 27C256 EPROM is a static sensitive device; proper precautions should be used when handling it.

f. Turn on power to the receiver/processor rack and connect IOT-3 to the serial port on the front of the receiver rack with the IOT-3 serial cable.

g. Initialize the computer by inserting the DOS/IOT-3 boot floppy in the floppy disk drive, powering on IOT-3, and logging on at the IOT-3 logon screen for calibration (see figure 6-1) to bring the "FAARMC" program on line. From the IOT-3 Main Menu (see figure 6-2) select item 2 Perform IOT-3/PC Management (see figure 6-3) and select item 1 Set Date/Time. If the date and time are correct, hit ENTER twice, if not, enter the correct date and time in the prompted format. From the VDF IOT-3 Main Menu select menu item 1 Calibrate DF Site (see figure 6-4). The DF must have several parameters set to specific values BEFORE the antenna offset or site correction data are collected. You can either choose the Manually Adjust Parameters option and enter the commands listed in subparagraphs 82g(1)-82g(7), or choose the Determine Antenna Offset option which will enter them automatically. The FAARMC program commands to setup initial parameters are:

(1)	STPSIZE80	Sets step size to 2 MHz increments.
(2)	STEPDWELL 5	Sets data collection to 5 bearings per step.
(3)	STARTCHAN 1	Sets first auto-scan channel to 1.
(4)	STOPCHAN 721	Sets last auto-scan channel to 721.
(5)	TR 0	Sets true bearing to 0.
(6)	FR 118	Sets starting frequency to 118.000 MHz.
(7)	SQ-140	Sets squelch to -140 dBm.

Enter 'STP' and RETURN to continue through calibration steps. When finished type in 'EXIT' and RETURN to get back to the calibration menu.

Keep in mind that the IOT-3 software has a HELP function available from the keyboard. This manual does not explain every detail of the software because much of it progresses logically from the screen menus.

h. The screen display on the computer during the system test will be in the following order: Channel, TR, bearing read, bearing difference, tone channels (5), date/time, vector sum all on one line.

FIGURE 6-1. IOT-3/PC LOGON SCREEN (CALIBRATION)

```
--- IOT3/PC LOGON ---

Enter USER ID (name): ?rene

Enter DF SITE ID (3 characters) ? dfa

Logon o.k.....

NOTE: Correction data for DFA EXISTS!

Strike any key when ready . . .
```

FIGURE 6-2. IOT-3 MAIN MENU (CALIBRATION)

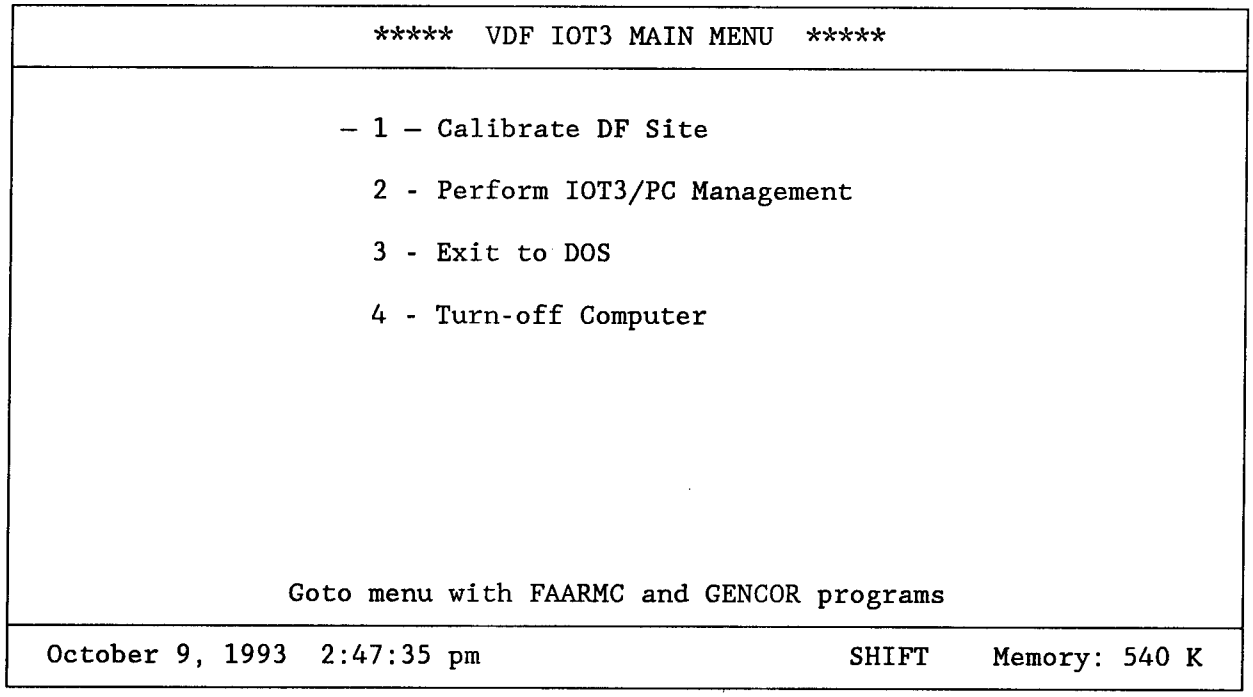
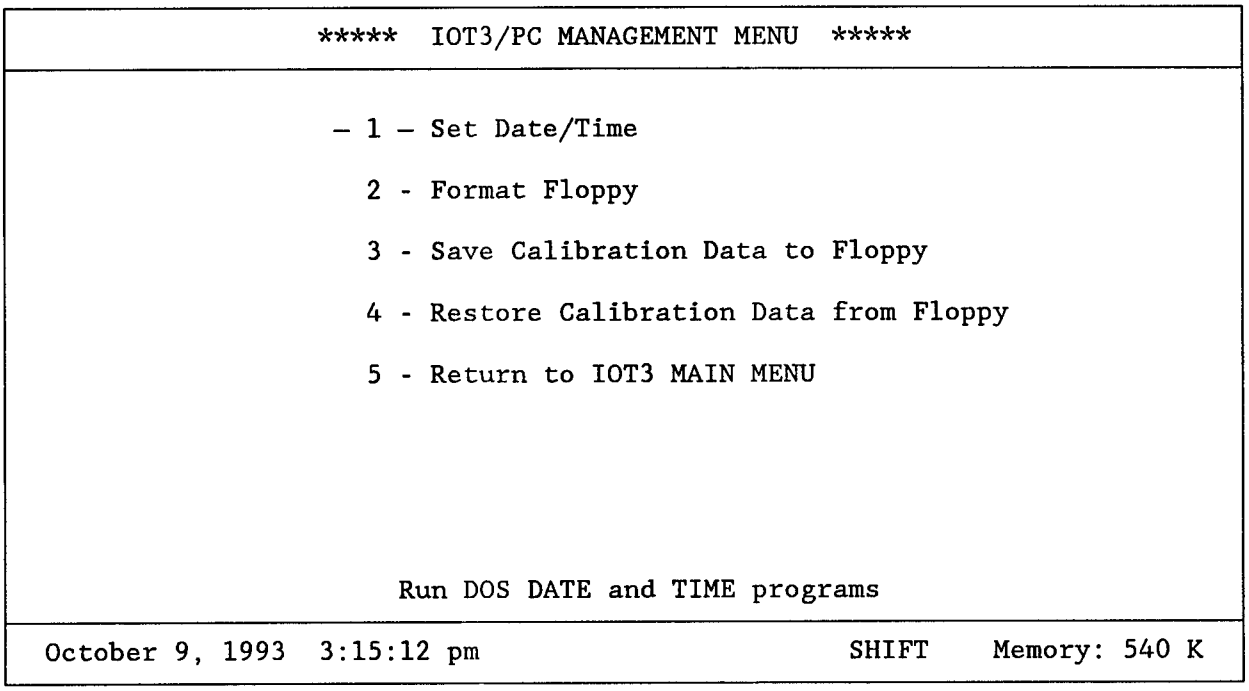
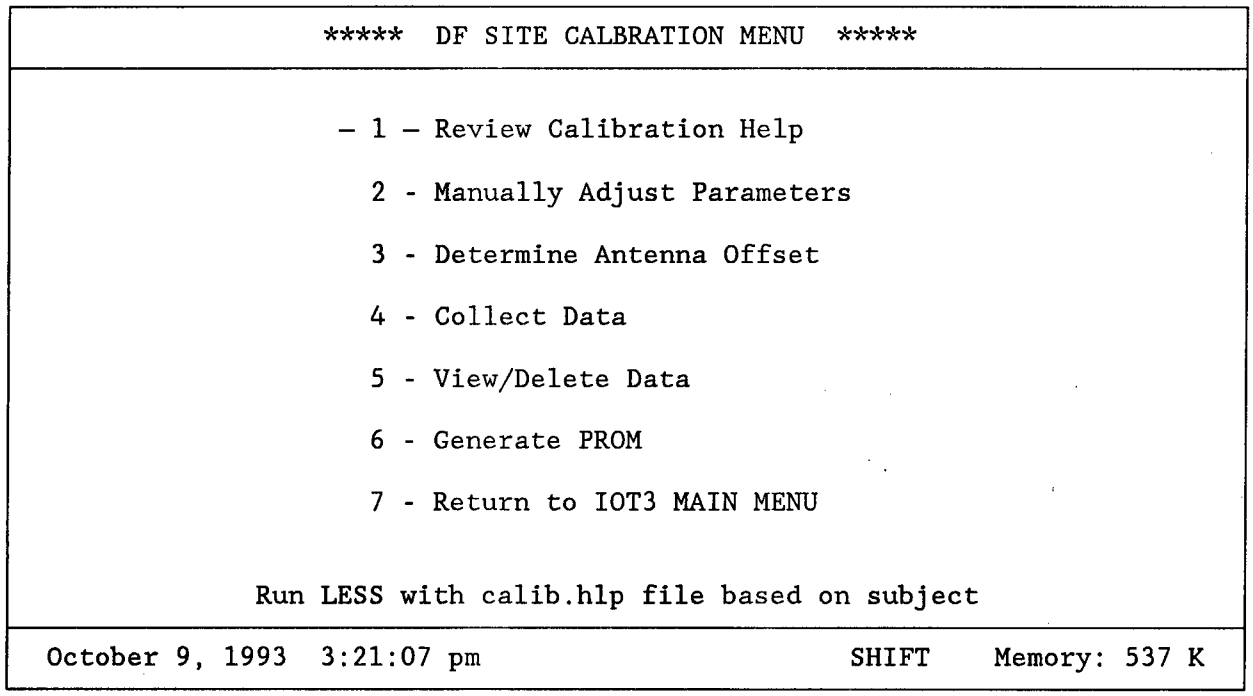


FIGURE 6-3. IOT-3/PC MANAGEMENT MENU (CALIBRATION)



Current date is Tue 10-9-1993
Enter new date (mm-dd-yy):
Current time is 15:16:41.27
Enter new time:

FIGURE 6-4. DF SITE CALIBRATION MENU



i. The antenna offset of the DF system must be determined and entered BEFORE site correction data is collected. The antenna offset parameter is defined to be the difference, in degrees, between the antenna's number 1 dipole and magnetic north. The following procedures shall be used to determine the antenna offset:

(1) Select the "Determine Antenna Offset" menu entry.

(2) Place the comb generator at the zero (0) degree marker, 150 feet from the DF antenna, and turn it on.

(3) Enter the FAARMC command "STP". Observe the bearing differences (column #4) and record the largest value displayed. After channel 721 the display will stop.

(4) Move the comb generator in 45 degree increments through 360 degrees. For each 45 degree increment, enter the FAARMC command "TR w" (where the "w" is the magnetic azimuth of the comb generator) and repeat step (3).

(5) To compute the antenna offset, average to the nearest 0.1 degree the smallest and largest values recorded in subparagraph 82i(3). Add these together and divide by two (2) to arrive at the antenna offset.

(6) Enter the antenna offset with the command "ANTOFFSET sddt", where s is the sign (+ or -), dd is degrees, and t is tenths of degrees.

NOTE: Retain the antenna offset value for future use. The antenna offset must also be entered in the appropriate DF SITE file via IOT-2 for normal use of the DF system.

(7) Return the comb generator to the zero (0) degree position.

(8) Enter FAARMC command "EXIT" to return to the calibration menu.

j. The Site Correction Data shall be collected using the following procedures:

(1) Select "Collect Data" menu entry and select "Generation" option. The data file is opened and the parameters are automatically set.

(2) Verify the comb generator is at the zero (0) magnetic degree marker and is turned on. Enter "CH 1" to reset filter and receiver.

(3) Enter the FAARMC command "STP". After channel 721 the display will stop.

(4) Place the comb generator at each of the 5 degree markers and enter the FAARMC command "TR w" (where the "w" is the magnetic azimuth of the comb generator) and enter "CH 1" then "STP".

(5) After collecting data at the 355 degree marker, enter the FAARMC command "EXIT" to close the data file and return to the calibration menu.

k. The burning of the correction table data on the PROM is accomplished by procedures in subparagraphs 82k(1)-82k(4).

(1) Disconnect the serial line from the computer to the VDF rack and connect the computer to the PROM burner. You will need to use the supplied null modem adapter between the cable and the PROM burner.

(2) Power-up the PROM burner and enable "ON LINE" condition with a new or erased 27C256 PROM installed in the "program" socket.

(3) Select "Generate PROM" from the DF Site Calibration Menu.

(4) After approximately 15 minutes, observe and follow the prompts to burn the correction PROM.

l. After generating the PROM, follow the procedures below to install and verify the site correction PROM:

(1) Power-down the DF system and install the PROM in MCP A Module (U4).

(2) Power-up the DF.

(3) Select "Collect Data" menu entry and select "Verify" option. The verification data file is opened and parameters are automatically set.

(4) Verify the comb generator is at the 0° marker and is turned on.

(5) Enter FAARMC command "STP". After channel 721 the display will stop.

(6) Place the comb generator at each 5° marker and enter the FAARMC command "TR w" (w is the azimuth of the comb generator) and "STP".

(7) Enter the FAARMC command "EXIT" after collecting data at 355° to close the data file and return to the calibration menu.

(8) Select "View/Delete Data" menu entry and select file "xxxVER" for viewing where xxx is the 3 character DF site ID.

(9) Scroll through the file using the up/down or page up/down keys and verify bearing variations do not exceed 3°.

m. Return to the IOT-3 Main Menu and select item 2 Perform IOT-3/PC Management. Select item 2 Format Floppy if you do not have a properly formatted floppy disk on which to save the calibration data. Using a formatted floppy, select item 3 Save Calibration Data to floppy and proceed as prompted.

n. The final step at the local site is to perform a System Certification Test as follows:

(1) Power on IOT-3 with no disk in the disk drive and logon to the RMMC program.

FIGURE 6-5. RMMC MAINTENANCE MENU

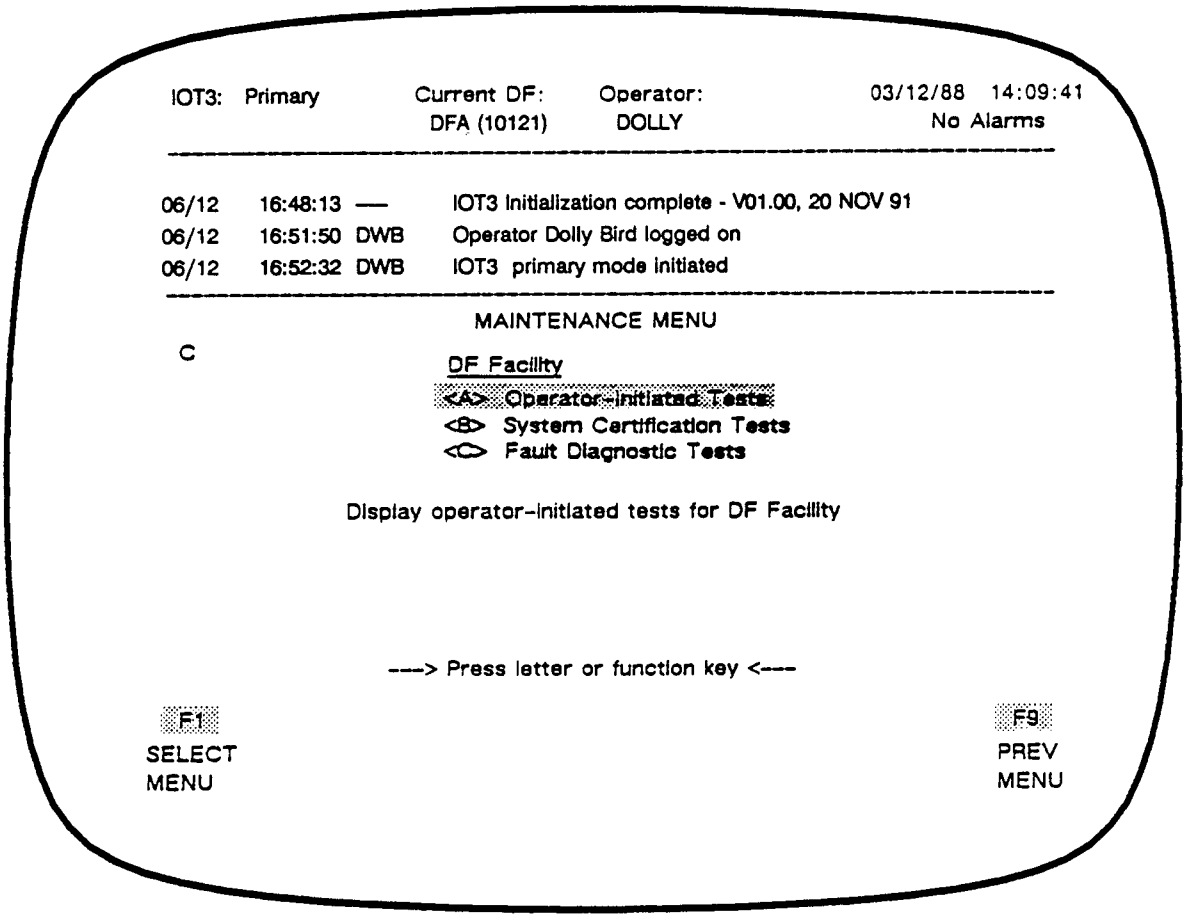
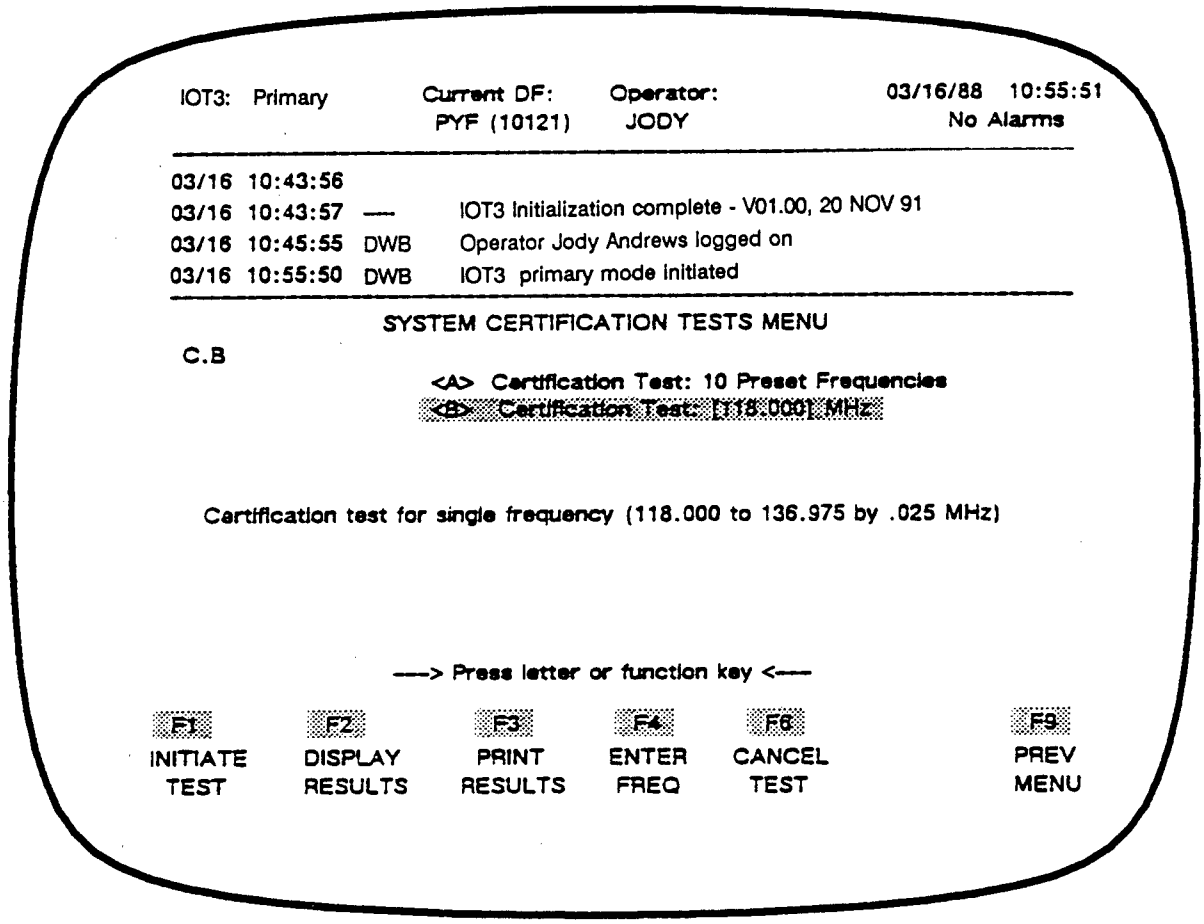


FIGURE 6-6. SYSTEM CERTIFICATION TESTS MENU



(2) Choose option <C> Maintenance from the RMMC Main Menu to access the Maintenance Menu (see figure 6-5).

(3) Choose option <B> System Certification Tests from the Maintenance Menu (see figure 6-6).

(4) Highlight option <B> on the System Certification Tests Menu to test at the single frequency 135.850 MHz.

(5) Enter the frequency 135.850 Hz.

(6) Depress RETURN and then depress F1 INITIATE TEST.

Messages indicating test start requested, test started, and test complete will appear in the system message area. The results can be viewed on-screen (F2 DISPLAY RESULTS) or printed out (F3 PRINT RESULTS). If the test fails, the operator will need to run Fault Diagnostic Tests to locate the cause of the failure. The Fault Diagnostic Tests are accessed through option <C> on the Maintenance Menu.

83. ALTERNATE SITE CALIBRATION PROCEDURES. The following paragraphs contain a procedure for site calibration without using the comb generator.

a. The following equipment is required for site calibration.

(1) Hand-held walkie-talkie or a signal generator (118-137 MHz).

(2) Target antenna (if walkie-talkie is not used).

NOTE: The signal generator or walkie-talkie must provide a signal strength of 50mv/meter or greater at the main array.

b. Prior to site calibration, verify that the VDF system has been properly installed and that the installation site has surveyed markers 150 feet from the center of the main array at 5 ± .1 degree increments.

c. The signal generator or walkie-talkie will be used in place of the comb generator in the steps outlined in paragraph 82. Where the comb generator radiates all 10 test frequencies simultaneously, allowing the IOT-3 software to automatically collect data at each radial, you will now need to change frequencies manually to step the program through these frequencies. For example, in subparagraph 82i(3), place the signal generator/walkie-talkie on the 0 degree marker on 118 MHz. Enter the command "STP" and transmit for several seconds. Change the frequency of the radiator to 120 MHz and transmit several seconds. Repeat through test frequencies and then at the appropriate radials. Follow the rest of paragraph 82 steps as usual.

84. FSS SITE AND DF SITE FILE MAINTENANCE. At this time it is necessary to perform site specific file updates using the following steps:

a. Highlight option <D> System Management from the Main Menu and depress F1 Select Menu to access the System Management Menu (see figure 6-7). From here, highlight and select option <D> FSS File Maintenance.

b. Highlight and select option <F> FSS Site File.

c. Enter the FSS site ID (determined by the FSS supervisor).

d. Enter the FSS building latitude/longitude.

e. Enter the latitude/longitude of the center point of the FSS area of interest .

f. Enter the vertical range (y-axis) of the FSS area of interest.

NOTE: These procedures will be performed again at the AFSS IOT-2 terminal.

g. Perform the steps described in subparagraphs 90a through 90o to modify the local DF Site File. These are procedures available at IOT-3 and IOT-2.

85. STARTUP. Once all the cabling at the AFSS/FSS has been done, perform the following steps for power-on procedures:

(1) Verify that the power indicators for the T-Bar power supply, the T-Bar Remote Controller, and the IDCU keyboards are illuminated. If not, check the connections to an AC power source.

(2) Verify that the Ethernet Intellink Module is connected to an ac power source, its rocker switch is in the "ON" position, and its power indicator is illuminated.

(3) Power on the modem(s) by positioning the switch on the modem mounting shelf to "ON."

(4) Power on the IOT-2 terminal with the switch located on the left side of the monitor platform and adjust the monitor's contrast and brightness if necessary. Power on the IOT-2 printer.

(5) Power on the IDCU monitors using the rocker switches located on the lower right side of each monitor.

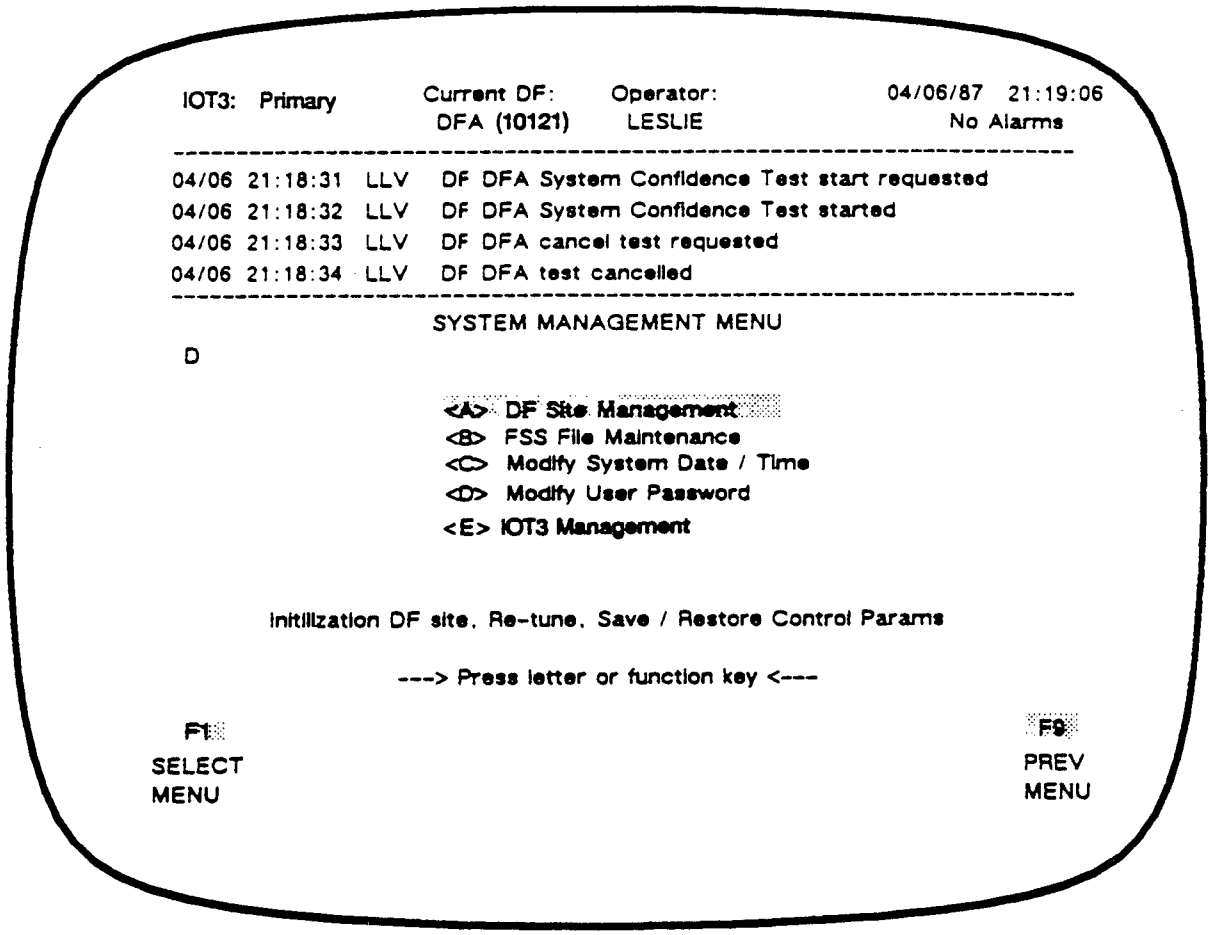
(6) Remove the lower front panels of the IDCU cabinets and power on the IDCU microcomputers using the MAIN POWER switches located on the upper right of the computers. Replace the cabinet panels.

(7) Power on each of the IDCU audio monitors by depressing the power switch. Depress the speaker push button switch and verify that it illuminates. Depress each channel switch and verify that they illuminate.

(8) Power on each of the RMMC computers using the rocker switches located on the right side of the rear panel (as you face the unit from the rear). All other VDF equipment at the AFSS site must be powered on BEFORE powering on the RMMC computers in order for the system to initiate itself properly.

The system will automatically initiate its tests and after a little time will

FIGURE 6-7. SYSTEM MANAGEMENT MENU FOR IOT-3



display the logon screen on IOT-2. The following operations are to be performed at the IOT-2 console. Note that the majority of these procedures are to be performed one time only when the AFSS VDF equipment is installed. When a VDF antenna system is being added to an already-installed AFSS system, only those procedures relating to that antenna system need to be performed at IOT-2. For a complete discussion of IOT-2 operation refer to TI 6530.11 Instruction Book, Volume 1, Section 3.

86. VDF SITE SPECIFIC CONFIGURATION.

a. Following the FSS and DF site equipment hardware installation, RMMC Data Files (VDF configuration) need to be modified to tailor the VDF system to site specific parameters before further system-level integration and checkout may begin. Site specific information includes:

(1) FSS hardware equipment configuration.

(2) DF site hardware equipment configuration.

(3) Operational configuration for electronics technician (maintenance).

(4) Operational configuration for Air Traffic specialist.

b. The VDF system is shipped to the AFSS/FSS with all VDF operational software and VDF configuration files resident. If it becomes necessary to perform an initial software load, refer to TI 6530.11, Volume 1, Section 9.9.1. If site specific geodata files need to be loaded, refer to TI 6530.11, Volume 1, Section 3.1.4.4.20. Although these files allow a complete VDF initialization, several specific parameters, determined only after hardware installation, need to be modified and/or verified for accuracy. The modification of other parameters is determined by the AFSS/FSS supervisor for the maintenance and Air Traffic specialist operations.

87. VDF CONFIGURATION FILE SITE ADAPTATION. Paragraphs 88 through 93 describe the records/fields in each VDF configuration file that are site specific and may require modification or verification. Data is entered based on FSS/DF hardware configuration, known geographic information (latitudes/longitudes), information gathered during DF site installation, or operational/maintenance requirements determined by the FSS supervisor. All records/fields not listed should not be changed from their defaults.

88. FSS SITE FILE. The FSS Site File is composed of a single record containing fields that specify site specific information about the AFSS/FSS itself. To configure this site specific information, perform the following steps:

a. Power-on all VDF equipment.

b. Logon to the RMMC that initialized as PRIMARY by typing in "LEVELFOUR" for the security level four user name and again typing in "LEVELFOUR" for the security level four password. If neither RMMC initialized into the PRIMARY state, logon to RMMC #1 and proceed with subparagraph 88.c, otherwise proceed to subparagraph 88.d.

c. Depress the Mode Menu hard function key to access the Mode Menu (see figure 6-8), highlight <C> Primary Mode, and depress F1 Initiate Mode to put RMMC #1 in primary mode. Depress F9 to return to the main menu.

d. Highlight option <D> System Management from the Main Menu and depress F1 Select Menu to access the System Management Menu. From here, highlight and select option <D> FSS File Maintenance.

e. Highlight and select option <F> FSS Site File.

f. Enter the FSS site ID (determined by the FSS supervisor).

g. Enter the FSS building latitude/longitude.

h. Enter the latitude/longitude of the center point of the FSS area of interest .

i. Enter the vertical range (y-axis) of the FSS area of interest.

89. FSS HARDWARE FILE. The FSS hardware file is composed of a single record containing fields that specify the hardware configuration of the FSS equipment and is accessed by selecting option <K> FSS Hardware File from the FSS File Maintenance Menu. To modify fields enter "Y" for each installed IDCU system. No other fields should be modified.

90. DF SITE FILE. The DF Site File is composed of multiple records. Each record specifies site specific information for an installed DF site (FA-10121 or FA-9964). To access this screen, select option <D> System Management Menu from the Main Menu, then select option <D> FSS File Maintenance. Next, highlight option <G> DF Site File and depress F1 Modify File. Modify and/or insert records as follows:

a. Position the cursor at <A> Record #. The Page Down key is used to scroll down through the file records and Page Up is used to scroll up. Moving to a specific record is accomplished by entering the desired record # and pressing RETURN. The TOP and BOTTOM keys move to the corresponding ends of the file. To add a record after the record currently on screen, depress F4 APPEND RECORD and input data for the new record.

b. Enter a "Y" in <B> Installed to indicate the DF site is installed.

c. Enter either "FAC" for an FA-10121 DF or "9964" for an FA-9964 DF for <C> Type.

d. Enter the three-character DF Location Identifier (LOCID) in <D> Site ID (determined by the AFSS supervisor).

e. Enter the latitude/longitude of the DF site antenna in <F> and <G> respectively.

f. Enter the 10 operational pre-set frequencies used during IDCU operation into <H> through <Q> (determined by the FSS supervisor).

g. Depress F6 Next Screen to continue modifying the DF site file.

FIGURE 6-8. REMOTE SITE MODE MENU

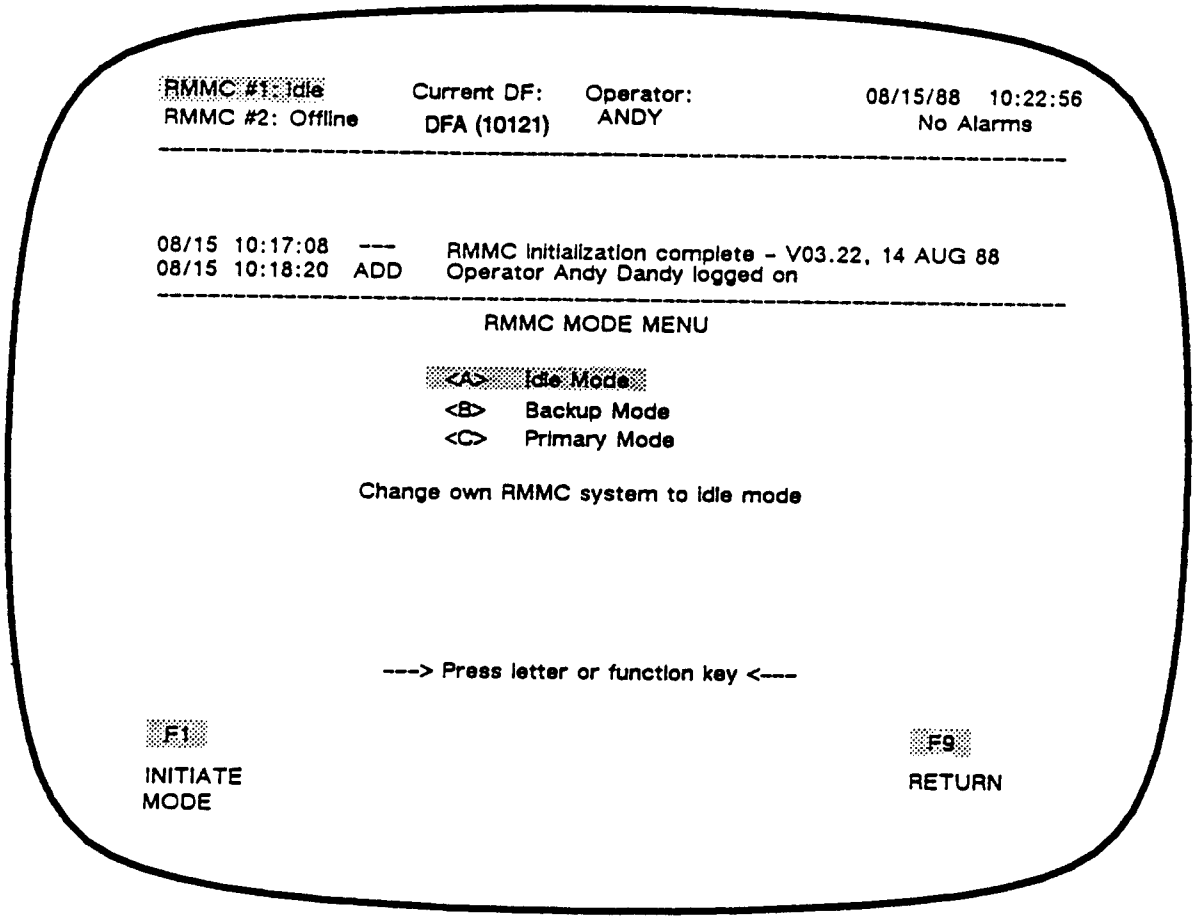


TABLE 6-1. RMMC/DF MODEM INPUT PORT DESIGNATIONS

VDF ANTENNA #:	RMMC REAR PANEL PORT DESIGNATION:	SOFTWARE PORT DESIGNATION:
1	J9	T6
2	J14	T5
3	J15	T7
4	J11	T8
5	J17	T9
6	J26	T10
7	J35	T11
8	J27	T12
9	J36	T13
10	J28	T14
11	J37	T15
12	J29	T16
13	J38	T17
14	J2	T18
15	J20	T19
16	J3	T20
17	J21	T21
18	J19	T22
19	J25	T23
20	J34	T24
21	J39	T25
22	J4	T26
23	J22	T27
24	J5	T28

h. Enter the antenna offset as sddt for <A> Antenna Offset where s is sign (+/-), dd is degrees, and t is tenths of degrees. (For example, an offset of 11.8 degrees would be entered as +118.) This value was determined during site installation and calibration. For an FA-9964 enter "0."

i. Enter the hardware RMMC port ID in option <B> used to communicate with the DF site (determined by hardware cabling). Refer to table 6-1 for cross-referencing of RMMC computer back panel "J" numbers to "T" port ID's.

j. Enter <C> Baud Rate of 600 for an FA-10121 type or 300 for an FA-9964 type.

k. Enter "Y" in <D> Filter Inst. if the preamplifier filter is installed with the FA-10121 site. Enter a "N" if it is not installed.

l. Enter the magnetic variation of the DF site antenna in <E> Magnetic Var. in degrees acquired off of the sectional map for that location from -359.9 + 359.9. For example, a "-6.1" indicates westerly variation of 6.1 degrees.

m. For an FA-10121, enter in <F> through <I> the target transmitter locations in degrees from 0 to 359, relative to magnetic north. If one or several of the target transmitters are not installed, enter "999" for each. For an FA-9964, enter "999" for all locations.

n. Enter the 10 certification frequencies used in maintenance testing in <J> through <S> (determined by the FSS supervisor).

o. Depress F1 Update Record when modification is complete then F6 Last Screen and F8 Save and Exit to exit the DF site file and record changes.

p. Once the site specific parameters within the appropriate VDF configuration files are modified, these files are then copied to the RMMC #2 hard disk and backed up on floppy. Use the following procedures:

(1) Logon to RMMC #2 using security level four user name/password.

(2) Using the FSS File Maintenance Menu, copy each modified VDF configuration file from RMMC #1 to RMMC #2 using the COPY FILE soft function key.

(3) Using the BACKUP FILE soft function key of the FSS File Maintenance Menu, back up each modified VDF configuration file to floppy.

(4) Logoff RMMC #1 and RMMC #2.

q. After the modified VDF configuration files have been copied to RMMC #2 hard disk and backed up to floppy, a startover is performed on the FA-10121 site(s) and the control parameters are set. Use the procedures contained in subparagraphs (1)-(6):

(1) Power-off, then power-on each RMMC and IDCU computer.

(2) After RMMC #1 logon screen is displayed, logon to RMMC #1 and RMMC #2 using security level four user name/password.

(3) Verify that RMMC #1 is in Primary Mode and RMMC #2 is in Backup Mode.

(4) Using the DF Site Management Menu and DF Select Menu, startover (cold start) each FA-10121 site.

(5) Verification messages are displayed that indicate configuration was started and completed for each FA-10121 site.

(6) Using the DF Facility Control Menu and DF Select Menu, enter and set control parameters (antenna gain, preamp gain, squelch threshold, audio gain, and filter In/Out) to values determined during FA-10121 installation. Defaults are initially shown for each.

r. At this point, preliminary testing of FSS and DF site equipment may begin.

91. CERTIFICATION LIMITS FILE. The Certification Limits File is composed of a single record containing fields that specify the reference limits used during certification testing and applies to all FA-10121 sites. No fields should be modified. The defaults define the accuracy of the VDF system established by the FAA program office.

92. TEST SCHEDULE FILE. The Test Schedule File is composed of single record containing fields that specify when a certification test is automatically initiated by the RMMC for each installed FA-10121. Enter a different day for each month (if desired) as determined by the FSS supervisor. A "0" indicates that the certification test will not be initiated for that month. The certification test will be initiated at midnight of the entered day, and only if the DF site is not in emergency mode.

93. SECURITY FILE. The Security File is composed of multiple records. Each record specifies the first/last name, initials, password, and security level for each valid RMMC operator. Enter records as determined by the FSS supervisor. The pre-defined users ("LEVELONE," "LEVELTWO," "SUPER," etc.) may be deleted once all users have been entered.

94. FACILITY AND CERTIFICATION TESTS. The facility and certification tests are discussed thoroughly in TI 6530.11. These tests can be accessed using the menu driven system from the IOT-2. From the RMMC Main Menu select <C> maintenance. For the facility test choose option <A> Operator-Initiated tests. The facility tests are then run from this menu. The certification tests are accessed from the Maintenance menu option <B> System Certification Test. From the System Certification Test menu option <B> provides running the test on a single frequency. For commissioning sites, this frequency is 135.850 MHz as stated in the VDF Purchase Description FAA-PD-420-02.

95. FLIGHT TEST. Finally a flight test is required as described in the United States Standard Flight Inspection Manuals (OAP) 8200.1 CH 29, dated July 10, 1978, paragraphs 212.1, 212.2, 212.3, 212.5 and 212.7. The flight test consists of verifying that the VDF can determine the bearing of an aircraft flying a 40 nautical mile orbit around the VDF antenna at an altitude approximating minimal line of sight (about 2,500 feet above ground level). Additionally, inbound and outbound radials are also flown. During the orbit frequencies shall be changed at least four times with a minimum of one change per quadrant. Position of the aircraft during the orbit will be verified every 10 degrees. Verification will be made using ground radar, the aircraft's inertial navigation system, or another acceptable airborne navigation system for reference. The following sample data sheets may be used to collect flight test data. The OAP standard for DF's is ±10 degrees. The operational standard for the FA-10121 VDF is ± 6 degrees.

96.-99. RESERVED.

TABLE 6-2. VDF FLIGHT TEST DATA SHEET

40 nautical mile orbit

Requested Bearings (degrees)	VDF Reported Bearings (degrees)	Bearing Difference (degrees)	Frequency (MHz)	Altitude (feet)
0				
10				
20				
30				
40				
50				
60				
70				
80				
90				
100				
110				
120				
130				
140				
150				
160				
170				
180				
190				
200				
210				
220				
230				
240				
250				
260				
270				
280				
290				
300				
310				
320				
330				
340				
350				

TABLE 6-2 VDF FLIGHT TEST DATA SHEET (CONT.)

Inbound/Outbound Station Passage

Reported Distance (nautical miles)	VDF Distance (nautical miles)	Difference (nautical miles)	Azimuth (degrees)	VDF Azimuth (degrees)	Azimuth Error (degrees)
40					
30					
20					
10					
9					
8					
7					
6					
5					
4					
3					
2					
1					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
20					
30					
40					

TABLE 6-2 VDF FLIGHT TEST DATA SHEET (CONCL.)

Altitude (feet): Frequency (MHz): _____

Verification method (Inertial Navigation System, Radar, etc.): _____
Date: _____

CHAPTER 7. VHF/DF SIMULATOR/TRAINER

100. DESCRIPTION AND INSTALLATION PROCEDURES. The VDF Simulator/Trainer is currently under development. A description and installation procedures for the simulator/trainer will be forthcoming when available.

101. - 109. RESERVED.

APPENDIX 1. LOCAL SITE INTERUNIT WIRING LIST

WIRE DESCRIPTION

Wire Designation LW1, LW2, LW3 LW4, LW5, LW6

Name of Circuit RF from Antenna Hub to Antenna Elec

	P1	P2
Connects to	Unit 8A2U2	Unit: 8A2U1
	Circuit _____	Circuit _____
	Jack _____	Jack _____
Connector type	N PLUG	N PLUG
Manufacturer	_____	_____
Mfgr's part number	_____	_____
Backshell part number	_____	_____
Strain relief	_____	_____
Length	_____	

Cable Type (Mfr & part no) _____

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins
Cables supplied with Unit 8		

WIRE DESCRIPTION

Wire Designation LW7, LW8, LW9, LW10

Name of Circuit RF to Target Antennas

	P1	P2
Connects to	Unit 8A2U3	Unit: 8A2U2
	Circuit _____	Circuit _____
	Jack _____	Jack J7, J8, J9, J10
Connector type	N PLUG	N PLUG
Manufacturer	Cablewave	Cablewave
Mfgr's part number	735000	735000
Backshell part number	_____	_____
Strain relief	_____	_____

Length SITE DEPENDENT

Cable Type (Mfr & part no) MIL-23806/2B (RG-331),NSN 6145-00-174-3587

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation LW11

Name of Circuit Antenna Control

	P1	P2
Connects to	Unit 8A2U2	Unit: Bldg. Entry Box
	Circuit	Circuit
	Term Bd. TB1, TB2	Term Bd. TB2, TB3
Connector type	LUG	LUG
Manufacturer		
Mfgr's part number	MS25036-102	MS25036-102
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-20MLF(2/20Sx10)0995

Number of conductors 20(10 pairs) Conductor size 20 AWG

P1 pins		SIGNAL		P2 pins
TB1-7	(BLK)	TXD	(BLK)	TB2-7
TB1-8	(WHT)	$\overline{\text{TXD}}$	(WHT)	TB2-8
TB1-9	SHLD		SHLD	TB2-9
TB1-11	(ORN)	RXD	(GRN)	TB2-11
TB1-10	(RED)	$\overline{\text{RXD}}$	(RED)	TB2-10
TB1-12	SHLD		SHLD	TB2-12
TB1-13	(BLU)	RST	(BLU)	TB2-13
TB1-14	(ORN)	$\overline{\text{RST}}$	(ORN)	TB2-14
TB1-15	SHLD		SHLD	TB2-15
TB1-4	(WHT/BLK)	FAULT	(WHT/BLK)	TB2-4
TB1-5	(RED/BLK)	$\overline{\text{FAULT}}$	(RED/BLK)	TB2-5
TB1-6	SHLD		SHLD	TB2-6
TB2-13	(GRN/BLK)	BEARING TONE 1	(GRN/BLK)	TB3-13
TB2-14	(ORN/BLK)	$\overline{\text{BEARING TONE 1}}$	(ORN/BLK)	TB3-14
TB2-15	SHLD		SHLD	TB3-15
TB2-11	(BLU/BLK)	BEARING TONE 2	(BLU/BLK)	TB3-11
TB2-10	(BLK/WHT)	$\overline{\text{BEARING TONE 2}}$	(BLK/WHT)	TB3-10
TB2-12	SHLD		SHLD	TB3-12
TB2-8	(RED/WHT)	BEARING TONE 3	(RED/WHT)	TB3-8
TB2-7	(GRN/WHT)	$\overline{\text{BEARING TONE 3}}$	(GRN/WHT)	TB3-7

WIRE DESCRIPTION

Wire Designation LW11 (Cont'd)

Name of Circuit Antenna Control

	P1	P2
Connects to	Unit 8A2U2	Unit: Bldg. Entry Box
	Circuit _____	Circuit _____
	Term Bd. TB1, TB2	Term Bd. TB2, TB3
Connector type	LUG	LUG
Manufacturer	_____	_____
Mfgr's part number	MS25036-102	MS25036-102
Backshell part number	_____	_____
Strain relief	_____	_____

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-20MLF(2/20Sx10)0995

Number of conductors 20(10 pairs) Conductor size 20 AWG

P1 pins		SIGNAL		P2 pins
TB2-9	SHLD		SHLD	TB3-9
TB2-5	(BLU/WHT)	BEARING TONE 4	(BLU/WHT)	TB3-5
TB2-4	(BLK/RED)	BEARING TONE 4	(BLK/RED)	TB3-4
TB2-6	SHLD		SHLD	TB3-6
TB2-2	(WHT/RED)	BEARING TONE 5	(WHT/RED)	TB3-2
TB2-1	(ORN/RED)	BEARING TONE 5	(ORN/RED)	TB3-1
TB2-3	SHLD		SHLD	TB3-3
N/C	(BLU/RED)	SPARE	(BLUE/RED)	N/C
N/C	(RED/GRN)	SPARE	(RED/GRN)	N/C
N/C	SHLD		SHLD	N/C

WIRE DESCRIPTION

Wire Designation LW12, LW13

Name of Circuit RF Antenna and BITE

	P1	P2
Connects to	Unit Bldg Entry Box	Unit: 8A2U2
	Circuit _____	Circuit _____
	Jack _____	Jack J10, J12
Connector type	N PLUG	N PLUG
Manufacturer	Cablewave	Cablewave
Mfgr's part number	735100	735100
Backshell part number	_____	_____
Strain relief	_____	_____

Length SITE DEPENDENT

Cable Type (Mfr & part no) MIL-C23806/1B (RG 333)

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation LW14

Name of Circuit Antenna Control

	P1	P2
Connects to	Unit U4	Unit: Bldg Entry Box
	Circuit	Circuit
	Conn. J6	Term Bd. TB2, TB3
Connector type	Bayonet	LUG
Manufacturer		
Mfgr's part number	MS3476L18-32P	MS25036-102
Backshell part number	M85049/52-1-1-18N	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-20MLF(2/20Sx10)0995

Number of conductors 20(10 pairs) Conductor size 20 AWG

P1 pins		SIGNAL		P2 pins
J6-A	(BLK)	TXD	(BLK)	TB2-7
J6-B	(WHT)	TXD	(WHT)	TB2-8
J6-C	SHLD		SHLD	TB2-9
J6-D	(ORN)	RXD	(GRN)	TB2-11
J6-E	(RED)	RXD	(RED)	TB2-10
J6-F	SHLD		SHLD	TB2-12
J6-G	(BLU)	RST	(BLU)	TB2-13
J6-H	(ORN)	RST	(ORN)	TB2-14
J6-J	SHLD		SHLD	TB2-15
J6-K	(WHT/BLK)	FAULT	(WHT/BLK)	TB2-4
J6-L	(RED/BLK)	FAULT	(RED/BLK)	TB2-5
J6-M	SHLD		SHLD	TB2-6
J6-N	(GRN/BLK)	BEARING TONE 1	(GRN/BLK)	TB3-13
J6-P	(ORN/BLK)	BEARING TONE 1	(ORN/BLK)	TB3-14
J6-R	SHLD		SHLD	TB3-15
J6-S	(BLU/BLK)	BEARING TONE 2	(BLU/BLK)	TB3-11
J6-T	(BLK/WHT)	BEARING TONE 2	(BLK/WHT)	TB3-10
J6-U	SHLD		SHLD	TB3-12
J6-V	(RED/WHT)	BEARING TONE 3	(RED/WHT)	TB3-8
J6-W	(GRN/WHT)	BEARING TONE 3	(GRN/WHT)	TB3-7

WIRE DESCRIPTION

Wire Designation LW14 (cont'd)

Name of Circuit Antenna Control

	P1	P2
Connects to	Unit U4	Unit: Bldg Entry Box
	Circuit	Circuit
	Conn. J6	Term Bd. TB2, TB3
Connector type	Bayonet	LUG
Manufacturer		
Mfgr's part number	MS3476L18-32P	MS25036-102
Backshell part number	M85049/52-1-18N	
Strain relief		
Length	SITE DEPENDENT	

Cable Type (Mfr & part no) CO-20MLF(2/20Sx10)0995

Number of conductors 20(10 pairs) Conductor size 20 AWG

P1 pins	SIGNAL		P2 pins
J6-X	SHLD	SHLD	TB3-9
J6-Y	(BLU/WHT) BEARING TONE 4	(BLU/WHT)	TB3-5
J6-Z	(BLK/RED) BEARING TONE 4	(BLK/RED)	TB3-4
J6-a	SHLD	SHLD	TB3-6
J6-b	(WHT/RED) BEARING TONE 5	(WHT/RED)	TB3-2
J6-c	(ORN/RED) BEARING TONE 5	(ORN/RED)	TB3-1
J6-d	SHLD	SHLD	TB3-3
J6-e	(BLU/RED) SPARE	(BLU/RED)	N/C
J6-f	(RED/GRN) SPARE	(RED/GRN)	N/C
J6-g	SHLD	SHLD	

WIRE DESCRIPTION

Wire Designation LW15

Name of Circuit TELCO

	P1	P2
Connects to	Unit 8A1U4	Unit: GFE Punchdown Block
	Circuit	Circuit
	Jack J7	Jack
Connector type		
Manufacturer		
Mfgr's part number	MS3476L12-8S	
Backshell part number	M85049/52-1-12N	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-08MLF (8/22) SJ0410

Number of conductors 8 Conductor size 22 AWG

P1 pins	SIGNAL	P2 pins
A	DIAL UPLINE	N/C
B	DIAL UPLINE (RTN)	N/C
C	SPARE	N/C
D	RING OF TX LINE	
E	TX TIP	
F	RING OF RCV LINE	
G	RX TIP	
H	SHLD	

WIRE DESCRIPTION

Wire Designation LW16

Name of Circuit AC POWER TO DF RACK

	P1	P2
Connects to	Unit 8A1U4	Unit: GFE AC Power Panel
	Circuit	Circuit
	Jack J1	Jack
Connector type		
Manufacturer		
Mfgr's part number	MS17344R20C15S	
Backshell part number	360CS002N2016M4	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-06MLF (6/12) 0635

Number of conductors 6 Conductor size 12 AWG

P1 pins		SIGNAL	P2 pins
A	BLK	CONV AC LINE	
B	WHT	CONV. AC NEUTRAL	
C	GRN	CONV AC GND	
D	GRN	AC GND (BATT)	
E	WHT	AC NEUTRAL (BATT)	
F	BLK	AC LINE (BATT)	

WIRE DESCRIPTION

Wire Designation LW17

Name of Circuit ENVIRONMENTAL SENSORS

	P1	P2
Connects to	Unit 8A1U4	Unit: GFE Sensor Intf.
	Circuit	Circuit
	Jack J8	Jack
Connector type		
Manufacturer		
Mfgr's part number	MS3476L20-41S	
Backshell part number	M85049/52-1-20N	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-40MLF (40/22)SJ0860

Number of conductors 40 Conductor size 22 AWG

P1 pins		SIGNAL	P2 pins
A	BLK	Power Line Monitor	
B	WHT	Power Line Monitor Rtn.	
C	GRN	Temp Sensor	
D	RED	Temp. Sensor Rtn.	
E	BLU	Smoke Det. 1	
F	ORN	Smoke Det. 1 Rtn.	
G	WHT w/BLK	Smoke Det. 2	
H	RED w/BLK	Smoke Det. 2 Rtn.	
J	GRN w/BLK	Intrusion Det.	
K	ORN w/BLK	Intrusion Det. Rtn.	
L	BLU w/BLK	Obstruction Light Sense	
M	BLK w/WHT	Obstruction Light Sense Rtn.	
N	RED w/WHT	GROUND	
P	GRN w/WHT	SPARE	
R	BLU w/WHT	VAC/1 Facility 1	
S	BLK w/RED	VAC/1 Facility 2	
T	WHT w/RED	VAC/1 Facility 3	
U	ORN w/RED	VAC/1 Facility 4	
V	BLU w/RED	VAC/1 Facility 5	
W	RED w/GRN	VAC/1 Facility 6	
X	ORN w/GRN	VAC/1 Facility 7	

WIRE DESCRIPTION

Wire Designation LW17 (Cont'd)

Name of Circuit ENVIRONMENTAL SENSORS

	P1	P2
Connects to	Unit 8A1U4	Unit: GFE Sensor Intf.
	Circuit	Circuit
	Jack J8	Jack
Connector type		
Manufacturer		
Mfgr's part number	MS3476L20-41S	
Backshell part number	M85049/52-1-20N	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-40MLF (40/22)SJ0860

Number of conductors 40 Conductor size 22 AWG

P1 pins		SIGNAL	P2 pins
Y	ORN w/WHT	VAC/Facility 8	
Z	GRN w/RED	VAC/Facility 9	
a	BLK w/GRN	VAC/Facility 10	
b	WHT w/GRN	GND	
c	BLU w/GRN	SPARE	
d	BLK w/ORN	VDC/Facility 1	
e	WHT w/ORN	VDC/Facility 2	
f	RED w/ORN	VDC/Facility 3	
g	GRN w/ORN	VDC/Facility 4	
h	BLU w/ORN	VDC/Facility 5	
i	BLK w/BLU	VDC/Facility 6	
j	WHT w/BLU	VDC/Facility 7	
k	RED w/BLU	VDC/Facility 8	
m	GRN w/BLU	VDC/Facility 9	
n	ORN w/BLU	VDC/Facility 10	
p	YEL	SPARE	
q	YEL w/BLK	SPARE	
r	YEL w/WHT	SPARE	
s		SHLD	
t	YEL w/RED	SPARE	

WIRE DESCRIPTION

Wire Designation LW18

Name of Circuit ANT RF

	P1	P2
Connects to	Unit 8A1U4	Unit: #9
	Circuit	Circuit
	Jack J9	Jack J4
Connector type	N PLUG	N PLUG
Manufacturer		
Mfgr's part number	M39012/01-0005	M39012/01-0005
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) M17/164-00001 (RG214), NSN 6145-00-660-8054

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation LW19

Name of Circuit BITE RF

	P1	P2
Connects to	Unit 8A1U4	Unit: Bldg. Entry Box
	Circuit	Circuit
	Jack J10	Jack LW13-P1
Connector type	N PLUG	N Receptacle
Manufacturer		
Mfgr's part number	M39012/01-0005	M39012/02-0003
Backshell part number		
Strain relief		
Length	SITE DEPENDENT	

Cable Type (Mfr & part no) M17/164-00001 (RG214), NSN 6145-00-660-8054

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation: LW20

Name of Circuit: PreAmp./Fltr. Control

	P1	P2
Connects to	Unit 8A1U4	Unit #9
	Circuit	Circuit
	Jack J5	Jack J2
Connector type	Bayonet	Bayonet
Manufacturer		
Mfgr's part number	MS3476L12-10S	MS3476L12-10SR
Backshell part number	M85049/52-1-12N	
Strain relief		

Length: SITE DEPENDENT

Cable Type (Mfr & part no): CO-08MLF(8/22)SJ0410

Number of conductors: 8 Conductor size: 22 AWG

P1 pins		SIGNAL	P2 pins
A	BLK	Data Rtn	J
B	WHT	$\overline{\text{BPF RST}}$	D
C	GRN	$\overline{\text{BPF FLT}}$	E
D	RED	SPARE	K
E	WHT w/BLK	RX DATA TX	B
F	RED w/BLK	SPARE	N/C
G		TX DATA RX	C
H		SPARE	N/C
J		SHLD	A

WIRE DESCRIPTION

Wire Designation LW21

Name of Circuit PreAmp./Fltr. Power

	P1	P2
Connects to	Unit 8A1U4	Unit #9
	Circuit	Circuit
	Jack J4	Jack J1
Connector type	Bayonet	Bayonet
Manufacturer		
Mfgr's part number	MS17344R18C11P	MS3106F18-11S
Backshell part number	360CS002N1816M4	N/A
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-06MLF(6/12)0635

Number of conductors 6 Conductor size 12

P1 pins		SIGNAL	P2 pins
A	BLK	MOTOR24VCOM	B
B	WHT	MOTOR +24VDC	A
C	GRN	ELEC 24VCOM	C
D	RED	ELEC +24VDC	D
E	BLU	SPARE	E

WIRE DESCRIPTION

Wire Designation LW22

Name of Circuit DC to Battery

	P1	P2
Connects to	Unit 8A1U4	Unit GFE Battery
	Circuit	Circuit
	Jack J2	Jack
Connector type	Bayonet	
Manufacturer		
Mfgr's part number	MS17344R28C22S	MS25036-123
Backshell part number	360CS002N2820M4	
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-02HLF(2/4)1035 (GFE)

Number of conductors 2 Conductor size 4 AWG

P1 pins		SIGNAL	P2 pins
A	BLK	BATT FORCE +	BLK
B	WHT	BATT FORCE -	WHT

WIRE DESCRIPTION

Wire Designation: LW23

Name of Circuit: Battery Sense

	P1	P2
Connects to	Unit 8A1U4	Unit GFE Battery Intf.
	Circuit	Circuit
	Jack J3	Jack
Connector type	Bayonet	
Manufacturer		
Mfgr's part number	MS3476L14-5S	MS25036-102
Backshell part number	M85049/52-1-14N	
Strain relief		

Length: SITE DEPENDENT

Cable Type (Mfr & part no): CO-02MLF(2/16)0335

Number of conductors: 2 Conductor size: 16 AWG

P1 pins		SIGNAL	P2 pins
A	BLK	+ SENSE	BLK
B	WHT	- SENSE	WHT
C	BLK	+ TEMP	BLK
D	WHT	- TEMP	WHT

WIRE DESCRIPTION

Wire Designation LW24, LW25

Name of Circuit AC to Obstruction Lights

	P1	P2
Connects to	Unit 8A2U2	Unit 8A2U1
	Circuit	Circuit
	Jack	Jack
Connector type		
Manufacturer		
Mfgr's part number	MS25036-107	MS25036-107
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-03MLF(3/14)0580

Number of conductors 3 Conductor size 14 AWG

P1 pins	SIGNAL	P2 pins

Cables supplied with Unit 8

WIRE DESCRIPTION

Wire Designation LW26

Name of Circuit Antenna Power

	P1	P2
Connects to	Unit Bldg Entry Box	Unit 8A2U2
	Circuit	Circuit
	Term Bd. TB1	Term Bd. TB3
Connector type	Lugs	Lugs
Manufacturer		
Mfgr's part number	See Table 1 below	
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) See Table 1

Number of conductors 2 Conductor size See Table 1

P1 pins		SIGNAL		P2 pins
TB1-1	BLK	Ant +24Vdc	BLK	TB3-1
TB1-2	WHT	Ant DC RTN.	WHT	TB3-2

Table 1

Cable Type	Length, Ft.	Term Lug
CO-02HLF(2/4)1035	1000 to 2000	MS25036-123
CO-02HLF(2/8)0805	500 to 1000	MS25036-116
CO-02HLF(2/10)0640	Up to 500	MS25036-157

WIRE DESCRIPTION

Wire Designation LW27

Name of Circuit AC Power to Obstruction Lights

	P1	P2
Connects to	Unit 8A2U2	Unit GFE AC Power
	Circuit	Circuit
	Term Bd.	Term Bd.
Connector type	Lugs	Lugs
Manufacturer		
Mfgr's part number	MS25036-107	MS25036-107
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) CO-03MLF(3/14)0580

Number of conductors 3 Conductor size 14AWG

P1 pins			SIGNAL	P2 pins
TB	1	BLK	AC HOT	BLK
TB	2	WHT	AC NEUTRAL	WHT
TB	3	GRN	Ground	GRN

WIRE DESCRIPTION

Wire Designation: LW28

Name of Circuit: Antenna Power

	P1	P2
Connects to	Unit 8A1U4	Unit Bldg Entry Box
	Circuit	Circuit
	Jack J13	Term Bd. TB1
Connector type	Bayonet	Lug
Manufacturer		
Mfgr's part number	M17344R28C22P	MS25036-123
Backshell part number	360CS002N2820M4	
Strain relief		
Length	SITE DEPENDENT	
Cable Type (Mfr & part no)	CO-02HLF(2/4)1035	
Number of conductors	2	Conductor size AWG4

P1 pins		SIGNAL		P2 pins
A	BLK	ANT +24VDC	BLK	TB1-1
B	WHT	ANT DC RTN	WHT	TB1-2

WIRE DESCRIPTION

Wire Designation: LW29, 30, 31, 32 (2005201)

Name of Circuit: Target Antenna RF

	P1	P2
Connects to	Unit: Target Antenna	Unit: Target Ant. Junction Box
	Circuit: _____	Circuit: _____
	Jack: _____	Jack: LW7, LW8, LW9, LW10, -P1
Connector type	BNC PLUG	BNC Recpt.
Manufacturer	_____	_____
Mfgr's part number	M39012/01-0503	M39012/02-0503
Backshell part number	_____	_____
Strain relief	_____	_____

Length: SITE DEPENDENT

Cable Type (Mfr & part no): M17160-RG142

Number of conductors: _____ Conductor size: _____

P1 pins	SIGNAL	P2 pins
Center Conductor	Target R.F.	Center Conductor
Shield		Shield

WIRE DESCRIPTION

Wire Designation LW33

Name of Circuit ANT RF

	P1	P2
Connects to	Unit 9	Unit Bldg Entry Box
	Circuit	Circuit
	Jack J13	Jack LW12-P1
Connector type	N PLUG	N Recpt.
Manufacturer		
Mfgr's part number	M39012/01-0005	M39012/02-0003
Backshell part number		
Strain relief		

Length SITE DEPENDENT

Cable Type (Mfr & part no) M17/164-00001 (RG214)

Number of conductors _____ Conductor size _____

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation LW3 (2005202)

Name of Circuit IOT3 to Receiver Processor

	P1	P2
Connects to	Unit 8	Unit IOT 3
	Circuit TO	Circuit
	Jack	Jack
Connector type	DB 25 (M)	DB 25 (F)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205207-1
Backshell part number	1-206478-2	1-206478-2
Pin	1-66506-0	
Socket		1-66504-0
Length	12 ft	

Cable Type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL	P2 pins
1	FR GRD BROWN	1
2	XMIT RED	2
3	REC ORANGE	3
5	CTS YELLOW	5
7	SIG GRD GREEN	7
8	CD BLUE	8
20	DSR PURPLE	20

WIRE DESCRIPTION

Wire Designation LW35 (Installation Option) (2005205)

Name of Circuit Battery Simulator

	P2	P1	P3
Connects to	Unit 8U4	Unit IOT 3	Temp. sensor 2000832-1
	Circuit	Circuit	
	Jack J2	Jack J2	
Connector type	Bayonet	Bayonet	Bayonet
Manufacturer			
Mfgr's part number	M17344R28C22S	MS3476L14-5S	MS3106F18-11S
Backshell part #	360CS002N2820M4	M85049/52-1-14N	
Strain relief	1-206478-2	1-206478-2	
Length	2 Ft.		As req'd

Cable Type (Mfr & part no) CO-02MLF (2/16) 0335

Number of conductors 2 Conductor size AWG 16 # of cond's 2 Cond. size 22

P1 pins	SIGNAL	P2 pins
B	BATT. FORCE +	A
A	BATT. FORCE -	B
P3 Pins		
A	TEMP. +	C
B	TEMP. -	D

WIRE DESCRIPTION

Wire Designation LRW1

Name of Circuit DF Rack RMMC Modem

	P1	P2
Connects to	Unit 8U4	Unit 1A3A2
	Circuit	Circuit
	Jack J7	Jack J3
Connector type	Screw on	Screw on
Manufacturer	Amphenol	Amphenol
Mfgr's part number	MS3476612-8S	MS3476L10-6S
Backshell part number	MS85040/52-112A	MS85040/52-110A
Strain relief		
Length	TBD	

Cable Type (Mfr & part no) GE MIL #CO-08MLF (8/22) SJ0410

Number of conductors 8 Conductor size 22 AWG

P1 pins	SIGNAL		P2 pins
H	SHLD	GND	A
E	TX TIP	TIP	B
D	TX RING		C
G	RX TIP		D
F	RX RING		E

APPENDIX 2. REMOTE SITE INTERUNIT WIRING LIST

WIRE DESCRIPTION

Wire Designation RW1 (2001201)

Name of Circuit IOT2- Computer A

	P1	P2
Connects to	Unit 1A5	Unit 3A1
	Circuit TO	Circuit
	Jack J31	Jack J1 (Modems)
Connector type	DB 25 (M)	DB 25 (F)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205207-1
Backshell part number	1-206478-2	1-206478-2
Pin	1-66506-0	
Socket		1-66504-0
Length	12 Ft	

Cable Type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL		P2 pins
1	FR GRD	BROWN	1
2	XMIT	RED	2
3	REC	ORANGE	3
5	CTS	YELLOW	5
7	SIG GRD	GREEN	7
8	CD	BLUE	8
20	DSR	VIOLET	20

WIRE DESCRIPTION

Wire Designation RW2 (2001202)

Name of Circuit IOT2- Computer B

	P1	P2
Connects to	Unit 1A6	Unit 3A1
	Circuit TO	Circuit
	Jack J31	Jack J2 (AUX)
Connector type	DB 25 (M)	DB 25 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Pin	1-66506-0	1-66506-0
Length	TBD	

Cable Type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL		P2 pins
1	FR GRD	BROWN	1
2	XMIT	RED	3
3	REC	ORANGE	2
5	CTS	YELLOW	5
7	SIG GRD	GREEN	7
8	CD	BLUE	8
20	DSR	VIOLET	20

WIRE DESCRIPTION

Wire Designation RW3 (2001202)

Name of Circuit 5110-Printer

	P1	P2
Connects to	Unit 1A9	Unit 2A1
	Circuit SWO	Circuit
	Jack C	Jack J1
Connector type	DB 25 (M)	DB 25 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Pin	1-66506-0	1-66506-0

Length TBD

Cable Type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL		P2 pins
1	FR GRD	BROWN	1
2	XMIT	RED	2
3	REC	ORANGE	3
5	CTS	YELLOW	5
7	SIG GRD	GREEN	7
8	CD	BLUE	8
20	DSR	VIOLET	20

WIRE DESCRIPTION

Wire Designation RW4 (2001204)

Name of Circuit ETHERNET 1

	P1	P2
Connects to	Unit 1A14	Unit 4A5
	Circuit	Circuit
	Jack 3	Jack J 30
Connector type	DB 15 (F)	DB 15 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205205-2	205206-1
Backshell part number	745172-2	745172-2
Pin		1-66506-0
Socket	1-66504-0	
Post		2-06514
Slide	745583-5	
Length	TBD	
Cable Type TCL Inc.	C0007	
Number of conductors	9 (4 pairs & ground)	Conductor size 22 AWG

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW5 (2001204)

Name of Circuit ETHERNET 2

	P1	P2
Connects to	Unit 1A14	Unit 5A5
	Circuit	Circuit
	Jack J4	Jack J30
Connector type	DB 15 (F)	DB 15 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205205-2	205206-1
Backshell part number	745172-2	7451172-2
Pin		1-66506-0
Socket	1-66504-0	
Post		206514
Slide	745583-5	
Length	TBD	

Cable Type TCL Inc.- C-0007

Number of conductors 9 (4 pairs & ground) Conductor size 22 AWG

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW6 (2001200)

Name of Circuit ETHERNET 3

	P1	P2
Connects to	Unit 1A14	Unit 6A5
	Circuit	Circuit
	Jack J5	Jack J30
Connector type	DB 15 (F)	DB 15 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205205-2	205206-1
Backshell part number	745172-2	745172-2
Pin		1-66506-0
Socket	1-66504-0	
Post		206514
Slide	745583-5	
Length	TBD	

Cable Type TCL Inc.- C-0007

Number of conductors 9 (4 pairs & ground) Conductor size 22 AWG

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW7 (2001200)

Name of Circuit ETHERNET 4

	P1	P2
Connects to	Unit 1A14	Unit 7A5
	Circuit	Circuit
	Jack J6	Jack J30
Connector type	DB 15 (F)	DB 15 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205205-2	205206-1
Backshell part number	745172-2	745172-2
Pin		1-66506-0
Socket	1-66504-0	
Post		206514
Slide	745583-5	
Length	TBD	

Cable type (Mfr & part no) TCL Inc. C-0007

Number of conductors 9 (4 pairs & ground) Conductor size 22 AWG

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW8 (2001203)

Name of Circuit AUDIO to Audio Dist. Box

	P1	P2
Connects to	Unit 1A3	Unit 5A6
	Circuit	Circuit
	Jack J3	Jack J1
Connector type	50 pin (M)	50 pin (F)
Manufacturer	AMP	AMP
Mfgr's part number	552032-1	229975-1
Backshell part number	4-552008-1	4-552008-1
Strain relief	Comes with	Comes with
Length	TBD	

Cable type (Mfr & part no) Alpha 5480/25

Number of conductors 25 pairs Conductor size AWG 24

P1 pins SIGNAL P2 pins

(see next page)

P1 pins		SIGNAL	P2 pins
1	Black	Audio Channel 1	1
2	White	Audio Channel 1	2
3	Brown	Audio Channel 3	3
4	White	Audio Channel 3	4
5	Red	Audio Channel 5	5
6	White	Audio Channel 5	6
7	Orange	Audio Channel 7	7
8	White	Audio Channel 7	8
9	Yellow	Audio Channel 9	9
10	White	Audio Channel 9	10
11	Green	Audio Channel 11	11
12	White	Audio Channel 11	12
13	Blue	Audio Channel 13	13
14	White	Audio Channel 13	14
15	Black	Audio Channel 15	15
16	Blue	Audio Channel 15	16
17	Brown	Audio Channel 17	17
18	Blue	Audio Channel 17	18
19	Red	Audio Channel 19	19
20	Blue	Audio Channel 19	20
21	Orange	Audio Channel 21	21
22	Blue	Audio Channel 21	22
23	Yellow	Audio Channel 23	23
24	Blue	Audio Channel 23	24
25	Black (of Black-Red)	SPARE	25
26	Green	Audio Channel 2	26
27	Blue	Audio Channel 2	27
28	Black	Audio Channel 4	28
29	Green	Audio Channel 4	29
30	Brown	Audio Channel 6	30
31	Green	Audio Channel 6	31
32	Red	Audio Channel 8	32
33	Green	Audio Channel 8	33
34	Orange	Audio Channel 10	34
35	Green	Audio Channel 10	35
36	Yellow	Audio Channel 12	36
37	Green	Audio Channel 12	37
38	Black	Audio Channel 14	38
39	Yellow	Audio Channel 14	39
40	Red	Audio Channel 16	40
41	Yellow	Audio Channel 16	41
42	Black	Audio Channel 18	42
43	Orange	Audio Channel 18	43
44	Red	Audio Channel 20	44
45	Orange	Audio Channel 20	45
46	Brown	Audio Channel 22	46
47	Red	Audio Channel 22	47
48	Black	Audio Channel 24	48
49	Brown	Audio Channel 24	49
50	Red (of Black-Red)	SPARE	50

WIRE DESCRIPTION

Wire Designation RW9 : NOT USED

WIRE DESCRIPTION

Wire Designation RW10 (2001203)

Name of Circuit AUDIO Dist. Box - IDCU 1

	P1	P2
Connects to	Unit 5A6	Unit 4A1
	Circuit	Circuit
	Jack J3	Jack J1
Connector type	50 pin (M)	50 pin (F)
Manufacturer	AMP	AMP
Mfgr's part number	552032-1	229975-1
Backshell part number	4-552008-1	4-552008-1
Strain relief	Comes with	Comes with
Length	30'	

Cable type (Mfr & part no) Alpha 5480/25

Number of conductors 25 pairs Conductor size AWG 24

P1 pins SIGNAL P2 pins

(see next page)

RW10 (CONT)

P1 pins		SIGNAL	P2 pins
1	Black	Audio Channel 1	1
2	White	Audio Channel 1	2
3	Brown	Audio Channel 3	3
4	White	Audio Channel 3	4
5	Red	Audio Channel 5	5
6	White	Audio Channel 5	6
7	Orange	Audio Channel 7	7
8	White	Audio Channel 7	8
9	Yellow	Audio Channel 9	9
10	White	Audio Channel 9	10
11	Green	Audio Channel 11	11
12	White	Audio Channel 11	12
13	Blue	Audio Channel 13	13
14	White	Audio Channel 13	14
15	Black	Audio Channel 15	15
16	Blue	Audio Channel 15	16
17	Brown	Audio Channel 17	17
18	Blue	Audio Channel 17	18
19	Red	Audio Channel 19	19
20	Blue	Audio Channel 19	20
21	Orange	Audio Channel 21	21
22	Blue	Audio Channel 21	22
23	Yellow	Audio Channel 23	23
24	Blue	Audio Channel 23	24
25	Black (of Black-Red)	SPARE	25
26	Green	Audio Channel 2	26
27	Blue	Audio Channel 2	27
28	Black	Audio Channel 4	28
29	Green	Audio Channel 4	29
30	Brown	Audio Channel 6	30
31	Green	Audio Channel 6	31
32	Red	Audio Channel 8	32
33	Green	Audio Channel 8	33
34	Orange	Audio Channel 10	34
35	Green	Audio Channel 10	35
36	Yellow	Audio Channel 12	36
37	Green	Audio Channel 12	37
38	Black	Audio Channel 14	38
39	Yellow	Audio Channel 14	39
40	Red	Audio Channel 16	40
41	Yellow	Audio Channel 16	41
42	Black	Audio Channel 18	42
43	Orange	Audio Channel 18	43
44	Red	Audio Channel 20	44
45	Orange	Audio Channel 20	45
46	Brown	Audio Channel 22	46
47	Red	Audio Channel 22	47
48	Black	Audio Channel 24	48
49	Brown	Audio Channel 24	49
50	Red (of Black-Red)	SPARE	50

WIRE DESCRIPTION

Wire Designation RW11

Name of Circuit Audio Dist. Box - IDCU 3

	P1	P2
Connects to	Unit 5A6	Unit 6A1
	Circuit	Circuit
	Jack J4	Jack J1
Connector type	50 pin (M)	50 pin (F)
Manufacturer	AMP	AMP
Mfgr's part number	552032-1	229975-1
Backshell part number	4-552008-1	4-552008-1
Strain relief	Comes with	Comes with
Length	30'	

Cable type (Mfr & part no) Alpha 5480/25

Number of conductors 25 pairs Conductor size AWG 24

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW12

Name of Circuit Audio Dist. Box - IDCU 4

	P1	P2
Connects to	Unit 5A6	Unit 7A1
	Circuit	Circuit
	Jack J5	Jack J1
Connector type	50 pin (M)	50 pin (F)
Manufacturer	AMP	AMP
Mfgr's part number	552032-1	229975-1
Backshell part number	4-552008-1	4-552008-1
Strain relief	Comes with	Comes with
Length	30'	

Cable type (Mfr & part no) Alpha 5480/25

Number of conductors 25 pairs Conductor size AWG 24

P1 pins	SIGNAL	P2 pins

WIRE DESCRIPTION

Wire Designation RW13 (2001205)

Name of Circuit 5110 - AUDIO CONTROL

	P1	P2
Connects to	Unit 1A9	Unit 4W13
	Circuit SW3	Circuit
	Jack C	Jack P1
Connector type	DB25 (M)	DB25 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Strain relief	Comes with	Comes with
Pin	1-66506-0	1-66506-0
Length	TBD	

Cable type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL Null Modem		P2 pins
1 Jumper to Pin 7	BLK	Chassis GND	N/C
2 XMIT	RED		3
3 REC	BLUE		2
7 Jumper to Pin 1	BLK	SIG GND	N/C

WIRE DESCRIPTION

Wire Designation RW14 (2001205)

Name of Circuit 5110 - AUDIO CONTROL 1-2

	P1	P2
Connects to	Unit 4W13	Unit 5W13
	Circuit	Circuit
	Jack P3	Jack P1
Connector type	DB25 (M)	DB25 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Strain relief	Comes with	Comes with
Pin	1-66506-0	1-66506-0
Length	30'	

Cable type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL		P2 pins
2	WHT	Rec	2
7	BLK	Gnd	7

WIRE DESCRIPTION

Wire Designation RW15 (2001205)

Name of Circuit AUDIO CONTROL 2-3

	P1	P2
Connects to	Unit 5W13	Unit 6W13
	Circuit	Circuit
	Jack P3	Jack P1
Connector type	DB25 (M)	DB25 (M)
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Strain relief	Comes with	Comes with
Pin	1-66506-0	1-66506-0

Length 30'

Cable type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24

P1 pins	SIGNAL	P2 pins
2	Wht Rec	2
7	Blk GND	7

WIRE DESCRIPTION

Wire Designation RW16 (2001205)

Name of Circuit AUDIO CONTROL 3-4

	P1	P2
Connects to	Unit 6W13	Unit 7W13
	Circuit	Circuit
	Jack P3	Jack P1
Connector type	DB25 (M) F	DB25 (M) F
Manufacturer	AMP	AMP
Mfgr's part number	205208-1	205208-1
Backshell part number	1-206478-2	1-206478-2
Strain relief	Comes with	Comes with
Pin	1-66506-0	1-66506-0
Length	30'	

Cable type (Mfr & part no) Belden 9614

Number of conductors 9 Conductor size AWG 24W

P1 pins	SIGNAL	P2 pins
2	Wht Rec	2
7	Blk GND	7

WIRE DESCRIPTION

Wire Designation RW17 (2001206)

Name of Circuit Monitor Power

	P1	P2
Connects to	Unit 1A3	Unit 4W16
	Circuit TB1	Circuit
	Jack	Jack P1
Connector type	Lugs #6	Molex (F)
Manufacturer	AMP	AMP
Mfgr's part number	2-34519-1 or 52929	480318-0
Socket		60619-1
Strain relief		
Length	TBD	

Cable type (Mfr & part no) Alpha 3241

Number of conductors 2 Conductor size AWG 18

P1 pins	SIGNAL			P2 pins
2	RETURN	Black	RETURN	4
1	+ 15VDC	White	+ 15VDC	3
				1
				2

WIRE DESCRIPTION

Wire Designation RW18 (2001207)

Name of Circuit Audio Monitor Power

	P1	P2
Connects to	Unit RW17	Unit 5W16
	Circuit	Circuit
	Jack P2	Jack P1
Connector type	Molex (M)	Molex (P)
Manufacturer	AMP	AMP
Mfgr's part number	1-480318-0	1-480318-0
Strain relief		
Pin	60619-1	
Socket		60619-1
Jumper		20 AWG Buss wire
Length	30'	

Cable type (Mfr & part no) Alpha 3241

Number of conductors 2 Conductor size AWG 18

P1 pins		SIGNAL		P2 pins
2	Ret	Black	Ret	2
1	+ 15VDC	White	+ 15VDC	1
				3
				4

WIRE DESCRIPTION

Wire Designation RW19

Name of Circuit Audio Monitor Power

	P1	P2
Connects to	Unit RW18	Unit 6W16
	Circuit	Circuit
	Jack P2	Jack P1
Connector type	Molex (M)	Molex (F)
Manufacturer	AMP	AMP
Mfgr's part number	1-480318-0	1-480318-0
Strain relief		
Pin	60619-1	
Socket		60619-1
Jumper		20 AWG Buss wire
Length	30'	

Cable type (Mfr & part no) Alpha 3241

Number of conductors 2 Conductor size AWG 18

P1 pins		SIGNAL		P2 pins
2	Ret	Black	Ret	2
1	+ 15VDC	White	+ 15VDC	1
				3
				4

WIRE DESCRIPTION

Wire Designation RW20

Name of Circuit Audio Monitor Power

	P1	P2
Connects to	Unit RW19	Unit 7W16
	Circuit	Circuit
	Jack P1	Jack P2
Connector type	Molex (M)	Molex (F)
Manufacturer	AMP	AMP
Mfgr's part number	1-480318-0	1-480318-0
Backshell part number		
Strain relief		
Pin	60619-1	
Socket		60619-1
Jumper		20 AWG Buss wire
Length	30'	

Cable type (Mfr & part no) Alpha 3241

Number of conductors 2 Conductor size AWG 18

P1 pins		SIGNAL		P2 pins
2	Ret	Black	Ret	2
1	+ 15VDC	White	+ 15VDC	1
				3
				4

WIRE DESCRIPTION

Wire Designation RW21

Name of Circuit Telco - Modem #1

	P1	P2
Connects to	Unit Telco J Box	Unit 1A3
	Circuit	Circuit A1
	Jack	Jack J3
Connector type	(M)	Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW22

Name of Circuit Telco Modem #2

	P1	P2
Connects to	Unit Telco J Box	Unit A3
	Circuit	Circuit A3
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW23

Name of Circuit Telco Modem #3

	P1	P2
Connects to	Unit Telco J Box	Unit A3
	Circuit	Circuit A4
	Jack	Jack J03
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation: RW24

Name of Circuit: Telco Modem #4

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW25

Name of Circuit Telco Modem #5

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW26

Name of Circuit Telco Modem #6

	P1	P2
Connects to	Unit Telco J Box	Unit A3
	Circuit	Circuit A7
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW27

Name of Circuit Telco Modem #7

	P1	P2
Connects to	Unit Telco J Box	Unit A3
	Circuit	Circuit A8
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04 MLF (2/22sx2) SJ

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW28

Name of Circuit Telco Modem #8

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW29

Name of Circuit Telco Modem #9

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation: RW30

Name of Circuit: Telco Modem #10

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A3
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW31

Name of Circuit Telco Modem #11

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A4
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW32

Name of Circuit Telco Modem #12

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW34

Name of Circuit Telco Modem #14

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A7
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW35

Name of Circuit Telco Modem #15

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A8
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW36

Name of Circuit Telco Modem #16

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A9
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW37

Name of Circuit Telco Modem #17

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A2
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW38

Name of Circuit Telco Modem #18

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A3
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW39

Name of Circuit Telco Modem #19

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A4
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110N
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW40

Name of Circuit Telco Modem #20

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110N
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW41

Name of Circuit Telco Modem #21

	P1	P2
Connects to	Unit Telco J Box	Unit A2
	Circuit	Circuit A5
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW42

Name of Circuit Telco Modem #22

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A7
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW43

Name of Circuit Telco Modem #23

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A8
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

WIRE DESCRIPTION

Wire Designation RW44

Name of Circuit Telco Modem #24

	P1	P2
Connects to	Unit Telco J Box	Unit A1
	Circuit	Circuit A8
	Jack	Jack J3
Connector type		Screw on(F)
Manufacturer		Amphenol
Mfgr's part number		MS3476L10-6S
Backshell part number		M85049/52-110A
Strain relief		
Length	TBD	

Cable type (Mfr & part no) CO-04MLF(2/24Sx2)SJ, Alpha 5902

Number of conductors 4 Conductor size 24 AWG

P1 pins	SIGNAL	P2 pins
	Gnd	A
	Tip	B
	Rec	C
	Tip	D
	Xmit	E

APPENDIX 3. TARGET TEST TRANSMITTER AND COMB GENERATOR SPECIFICATIONS

Target test transmitters:

Power output of test transmitters:
-16 dBm (25 microwatts typical).
(Cable loss of approximately 1 dB from transmitter to antenna not accounted for.)

Power gain of target antenna:
+5 dBi (typical).

Anttenna type and directional nature (basic pattern):

Type:	3 element Yagi
Pattern:	Cardioid
Front-back ratio:	10 dB (typical)
Beam width:	-3 dB at ±45° (typical).

Modulation type:
None - continuous wave (CW). Keyed on for less than 5 seconds during automated testing.

Carrier type:
Continuous wave (CW).

Frequency of transmissions:
118.000 - 136.975 MHz in 25 KHz steps. The target antennas transmit on the frequency to which the VDF is tuned for the system confidence test. The certification test is run either on 135.850 MHz, or on ten preset frequencies within the 118.000 - 136.975 MHz range.

Occupied bandwidth of carrier:
Less than 5 KHz on a single frequency (a CW carrier with no modulation theoretically occupies no bandwidth).

COMB generator:

Power output:
- 30 dBm further attenuable by 3, 10, 20, or 30 dB.

Power gain of antenna:
0 dB.

Antenna type and directional nature:
Omnidirectional walkie-talkie type whip antenna.

Modulation type:
None - continuous wave (CW).

Carrier type:
Continuous wave (CW).

Frequency of transmissions:
Continuous transmission on the following ten frequencies (in MHz):
118.0, 120.0, 122.0, 124.0, 126.0, 128.0, 130.0, 132.0, 134.0, 136.0.

Occupied bandwidth of carrier:
Less than 5 KHz on a single frequency (a CW carrier with no modulation theoretically occupies no bandwidth).